PATENT ABSTRACTS OF JAPAN

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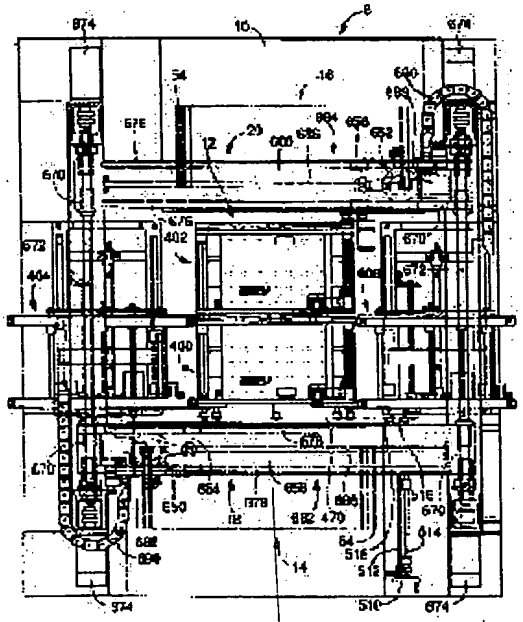
(54) CIRCUIT PARTS FITTING SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a system of high fitting efficiency, where plural parts holding tools turn around a common shaft, they move between parts supply devices and a circuit base material, and they receive/fit circuit parts.
SOLUTION: A board conveyor 12, two circuit parts supply devices 14 and 16 and circuit parts fitting devices 18 and 20 are provided on a base 10. The circuit parts fitting devices 18 and 20 are provided with intermittent rotors which hold plural parts adsorption shafts, intermittently rotate them and sequentially stop them in parts adsorption device positions, with fitting beads 650 and 652 having individual elevating devices elevating and lowering the parts adsorption shafts in the parts adsorption fitting devices and adsorbing and releasing the circuit parts and with XY robots 662 and 664 moving the fitting heads 650 and 652 to arbitrary positions in a horizontal plane. The plural parts adsorption shafts sequentially take out the circuit parts by the intermittent rotation and movement of the intermittent rotors. The shafts move on the circuit base material and the circuit parts held by the intermittent rotation and movement of the intermittent rotors are sequentially fitted to the circuit base material.



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CLAIMS

[Claim(s)]
[Claim 1] The components feeder which supplies passive circuit elements, and the circuit base material supporting structure holding the circuit base material which should equip with said passive circuit elements, While holding two or more components holders which hold passive circuit elements, respectively, and the components holder of these plurality and making it circle around a common fixed pivot line The holder slewing gear made [the components receipt location and components stowed position which were beforehand defined on the revolution locus] to carry out a sequential halt, Have a migration member for conveyance holding the holder slewing gear, and it is held at the migration equipment for conveyance made to move a holder slewing gear to the location of the arbitration within the conveyance flat surface over said components feeder and said circuit base material supporting structure by moving the migration member for conveyance, and said migration member for conveyance. The lifting device which makes it go up and down a components holder in a components receipt location and a components stowed position at least, The receipt wearing control unit which makes the circuit base material which was made to receive the passive circuit elements supplied to said components holder from said components feeder in said components receipt location, and was held in the components stowed position at said circuit base material supporting structure equip with passive circuit elements, The passive-circuit-elements wearing system characterized by including the control unit which controls said holder slewing gear, said migration equipment for conveyance, said lifting device, and said receipt wearing control unit.
[Claim 2] The passive-circuit-elements wearing system according to claim 1 which said holder slewing gear makes the components receipt stowed position which is also said components receipt location or said components maintenance location carry out a sequential halt of said two or more components holders, and is characterized by said lifting device being the thing which makes it go up and down each part article holder in the components receipt stowed position at least.
[Claim 3] While having said components feeder on every two one both sides of said circuit base material supporting structure 2 SE 1 TO ** of the wearing unit containing said two or more components holders, said holder slewing gear, said migration equipment for conveyance, said lifting device, and said receipt wearing control unit is carried out. While said two components feeders and said circuit base material supporting structure are made to stand it still during wearing at least Said control unit makes one side of said two-set wearing unit receive passive circuit elements from one side of said two components feeders, and makes it equip said circuit base material. Make another side of a wearing unit receive passive circuit elements from another side of a components feeder, and said circuit base material is made to equip it. And the passive-circuit-elements wearing system according to claim 1 or 2 characterized by including the mutual wearing control means which makes the receipt of passive circuit elements, and wearing perform to a these two sets wearing unit by turns.
[Claim 4] The image pick-up equipment which is held in the condition of countering said migration member for conveyance at the passive circuit elements held at said components holder, and picturizes passive circuit elements, Based on the image of the passive circuit elements acquired by the image pick-up equipment, the maintenance position error of the passive circuit elements by said components holder is acquired. Claim 1 characterized by including a positioning amendment means to amend positioning to said circuit base material supporting structure of said holder slewing gear by said migration equipment for conveyance based on the maintenance position error thru/or the passive-circuit-elements wearing system of any one publication of three.
[Claim 5] While said components holder is held pivotable by said holder slewing gear at the circumference of the axis of a components holder The holder slewing gear which makes said migration member for conveyance rotate a components holder around the axis of the components holder is held. And the image pick-up equipment with which the circuit base material wearing system concerned is held in the condition of countering said migration member for conveyance at the passive circuit elements held at said components holder, and picturizes passive circuit elements, Based on the image of the passive circuit elements acquired by the image pick-up equipment, the maintenance bearing error of the passive circuit elements by said components holder is acquired. Claim 1 characterized by including a bearing amendment means to control said holder slewing gear based on the maintenance bearing error, and to amend a maintenance bearing error thru/or the passive-circuit-elements wearing system of any one publication of four.
[Claim 6] Furthermore, by being prepared possible [rise and fall] with each part article holder to the cam member equipped with the cam side where the height formed along with the revolution locus of two or more of said components holders changes, and each of two or more of said components holders, and engaging with said cam side The cam follower which makes it go up and down a components holder with revolution of a components holder is included. And the passive-circuit-elements wearing system according to claim 4 or 5 characterized by arranging said image pick-up equipment in the location corresponding to a part higher than the part at least corresponding to one side of said components receipt location of said cam side, and said components stowed position.
[Claim 7] Furthermore, by being prepared possible [rise and fall] with each part article holder to the cam member equipped with the cam side where the height formed along with the revolution locus of two or more of said components holders changes, and each of two or more of said components holders, and engaging with said cam side The cam follower which

makes it go up and down a components holder with revolution of a components holder is included. And claim 1 characterized by setting at least one side of said components receipt location and said components stowed position as the location corresponding to the lowest part of said cam side thru/or the passive-circuit-elements wearing system of any one publication of five.
[Claim 8] Said holder slewing gear carries out fixed include-angle [every] intermittent rotation, and is equipped with the intermittent body of revolution which holds said two or more components holders at intervals of the include angle of the integral multiple of the intermittent angle of rotation. Said image pick-up equipment is formed in one of two or more of the halt locations of the components holder by halt of intermittent body of revolution, and the halt location is made into a components image pick-up location. Claim 4 characterized by being set as the halt location where said components receipt location and said components stowed position differ from the components image pick-up location thru/or the passive-circuit-elements wearing system of any one publication of seven.
[Claim 9] Said holder slewing gear is what rotates said two or more components holders all at once. Where some passive circuit elements which all the passive circuit elements by which it is planned that the passive-circuit-elements wearing system concerned is received by these components holder were received, and were held by these components holder are picturized by said image pick-up equipment Said migration equipment for conveyance is made to move said holder slewing gear to said circuit base material upper part. The passive-circuit-elements wearing system according to claim 8 characterized by including the concurrency image pick-up control means which makes passive circuit elements picturize to said image pick-up equipment in parallel to making the components holder which is in said lifting device in said components stowed position equip with passive circuit elements.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to amelioration of the system which equips circuit base materials, such as a printed circuit board, with the passive circuit elements which constitute the electrical and electric equipment and an electronic circuitry.
[0002]
[Description of the Prior Art] There is a system of various modes among the passive-circuit-elements wearing systems. For example, the passive-circuit-elements wearing system given in JP,2-53954,B is equipped with the holder slewing gear revolved in two or more components holders and the components holder of these plurality around a perpendicular common fixed pivot line, the components feeder which supplies passive circuit elements, and the circuit base material supporting structure holding a circuit base material. A holder slewing gear is formed in the circumference of a perpendicular axis pivotable, and has the body of revolution which holds two or more components holders to an equiangular distance, and the intermittent slewing gear which carries out intermittent rotation of the body of revolution. By making body of revolution carry out intermittent rotation, two or more components holders are made to carry out a sequential halt by two or more halt locations, and equip a circuit base material with passive circuit elements in them in the components stowed position which are reception and another halt location about passive circuit elements in the components receipt location which is one of the halt locations of these plurality from a components feeder. A components feeder has two or more components supply cartridges carried on the trolley table. Two or more components supply cartridges are carried in a trolley table in the condition that each part article feed zone is located in a line in the shape of a straight line, and one of two or more of the components supply cartridges is positioned in a components supply location by moving a trolley table in the direction parallel to a top Norikazu straight line by trolley table migration equipment. Moreover, a circuit base material is moved to the location of the arbitration within a horizontal plane by the circuit base material supporting structure with circuit base material migration equipment, where positioning maintenance is carried out, two or more components wearing parts are positioned under the components holder positioned in the components stowed position one by one, and it is equipped with passive circuit elements. According to this passive-circuit-elements wearing system, two or more components holders can arrive at a components receipt location and a components stowed position with a short time interval, and it can receive and equip with sequential-circuit components. However, in this passive-circuit-elements wearing system, although the trolley table which supports two or more components supply cartridges, and the circuit base material supporting structure which carries out positioning maintenance of the circuit base material must be moved, since these trolley tables and the circuit base material supporting structure are large-sized, a large migration tooth space must be secured and it cannot avoid that a system becomes large-sized. Moreover, although they are prepared in the location in which it does not interfere mutually even if the trolley table and the circuit base material supporting structure of a components feeder move, respectively Since a circuit base material must be moved to the location of the lower part of the components holder positioned in the components stowed position by all the components wearing parts of a circuit base material, A successive range is wide and the distance of the components stowed position set as the mid-position of the successive range of a circuit base material and a components receipt location becomes long in the direction in which a components feeder and the circuit base material supporting structure are located in a line. Therefore, it is difficult for body of revolution to become large-sized and to enlarge intermittent rotational speed.
[0003] To it, the body of revolution which holds two or more components holders and is made to carry out intermittent rotation by the circumference of a perpendicular axis is moved to the location of the arbitration within a horizontal plane by the passive-circuit-elements wearing system given in JP,6-196546,A with migration equipment, and the components holder is constituted so that passive circuit elements may be taken out from the components feeder prepared by fixing a location, respectively and a circuit base material may be equipped. Two or more components holders are held possible [rise and fall] at body of revolution, about each of two or more components holders, body of revolution is made to go up and down a components holder, and the holder selecting arrangement moved to the operation location which is a downward location and performs the receipt of passive circuit elements and wearing, and the non-acting location which is a rise location and does not perform the receipt of passive circuit elements and wearing is formed in it. These holder selecting arrangement is formed in the attachment component fitting of the relative displacement of to relative rotation impossible and shaft orientations was made possible to body of revolution, and the selected components holder performs the receipt of passive circuit elements, and wearing by dropping an attachment component, after one of holder selecting arrangements has located the components holder in an operation location. After reception and two or more components holders receive passive circuit elements for passive circuit elements in this passive-circuit-elements wearing system, respectively by carrying out sequential positioning of two or more components holders in the components receipt location set up about one of two or more halt locations by intermittent rotation of body of revolution, it is moved to up to a circuit base material, and a circuit base material is equipped with passive circuit elements. A components stowed position is not decided as one, but a components holder equips a circuit

base material with passive circuit elements in one of the arbitration of two or more halt locations on a revolution locus. Since the holder selecting arrangement is formed about each of two or more components holders, a components holder can equip with passive circuit elements also in which halt location. According to this passive-circuit-elements wearing system, various effectiveness is acquired. For example, since the cartridge support table or the circuit base material supporting structure in which the components supply cartridge was carried do not move, they do not need to secure the migration tooth space of a large-sized cartridge support table or the circuit base material supporting structure, and can constitute the whole system in a compact. There are many classes of passive circuit elements supplied especially, and since a cartridge support table and the circuit base material supporting structure become large-sized when there are many components supply cartridges, or when a circuit base material is large, the space-saving effectiveness by not moving them is large. Moreover, a components feeder and the circuit base material supporting structure can be put in order that there is almost no clearance, and can be prepared, and a system can be constituted in a compact also in the point. Furthermore, that what is necessary is just to have the magnitude which can hold two or more components holders, as compared with body of revolution given in said JP,2-53954,B, it can be made small, intermittent rotational speed is made high, and body of revolution can shorten the working hours (time amount required by maintenance termination or wearing termination of the passive circuit elements by another side from maintenance termination or wearing termination of the passive circuit elements by one side of two adjoining components holders) of 1 cycle. The compaction effectiveness of working hours is so large that it has many components holders.

[0004]

[Problem(s) to be Solved by the Invention] However, since it is not decided in the passive-circuit-elements wearing system of a publication one that a components stowed position will be JP,6-196546,A, there is a problem which requires time amount for wearing of passive circuit elements. The distance between the components holders holding the passive circuit elements which equip these two components wearing parts with body of revolution, respectively in addition to the distance between two components wearing parts where a circuit base material gets mixed up, and it is equipped with passive circuit elements must also be moved, and it takes time amount. Moreover, if a components receipt location differs from a components stowed position, maintenance bearings of passive circuit elements differ in the time of a receipt and wearing, but if body of revolution is rotated in order to amend maintenance bearing, also by it, migration length may become far and wearing may take time amount. Although the location within the horizontal plane of a components holder can be changed and a components holder can also be brought close to the location which corresponds to a components wearing part by that cause if body of revolution is rotated even if there is no need for amendment of maintenance bearing, when bearing of passive circuit elements changes, calculation of the migration length of migration equipment is also troublesome. While two or more components holders are revolved by the circumference of a common axis, the 1st invention concerning claim 1 is a system which between a components feeder and the circuit base material supporting structure is moved, and performs the receipt of passive circuit elements, and wearing, and it succeeds as a technical problem in offering the system by which the time amount concerning wearing of passive circuit elements is short, and ends. The 2nd invention concerning claim 2 makes it a technical problem to make combination the lifting device of a components receipt location and a components stowed position in the passive-circuit-elements wearing system concerning the 1st invention. The 3rd invention concerning claim 3 makes it a technical problem for wearing to the circuit base material of passive circuit elements to be performed by 2 sets of wearing units, and to offer the high system of wearing efficiency. The 4th invention concerning claim 4 makes a technical problem the system distribution which can amend the maintenance position error of passive circuit elements. The 5th invention concerning claim 5 makes a technical problem the system distribution which can amend the maintenance bearing error of passive circuit elements. The 6th invention concerning claim 6 makes a technical problem a system distribution that installation of image pick-up equipment is easy and compact. The 7th invention concerning claim 7 makes a technical problem the system distribution which can locate in a high location components holders other than the components holder which performs at least one side of the receipt of passive circuit elements, and wearing. The 8th invention concerning claim 8 makes a technical problem the system distribution which can perform a receipt or maintenance in parallel as the image pick-up of passive circuit elements. Image pick-up and wearing of passive circuit elements are performed in parallel, and the 9th invention concerning claim 9 makes the high system distribution of wearing efficiency a technical problem.

[0005]

[The means for solving a technical problem, an operation, and an effect of the invention] In order that the passive-circuit-elements wearing system concerning the 1st invention may solve the above-mentioned technical problem (A) The components feeder which supplies passive circuit elements, and the circuit base material supporting structure holding the circuit base material which should equip with (B) passive circuit elements, (C) While holding two or more components holders which hold passive circuit elements, respectively, and the components holder of (D) these plurality and making it circle around a common fixed pivot line The holder slewing gear made [the components receipt location and components stowed position which were beforehand defined on the revolution locus] to carry out a sequential halt, (E) Have a migration member for conveyance holding the holder slewing gear, and it is held at the migration equipment for conveyance made to move a holder slewing gear to the location of the arbitration within the conveyance flat surface over a components feeder and the circuit base material supporting structure by moving the migration member for conveyance, and the migration member for (F) conveyance. The lifting device which makes it go up and down a components holder in a components receipt location and a components stowed position at least, (G) The receipt wearing control unit which makes the circuit base material which was made to receive the passive circuit elements supplied to a components holder from a components feeder in a components receipt location, and was held in the components stowed position at the circuit base material supporting structure equip with passive circuit elements, (H) It is constituted so that the control unit which controls a holder slewing gear, the migration equipment for conveyance, a lifting device, and a receipt wearing control unit may be included.

[0006] In this passive-circuit-elements wearing system, while two or more components holders are moved one by one to a components receipt location by revolution of the components holder by the holder slewing gear, and migration of the holder slewing gear by the migration equipment for conveyance, it is positioned in the location corresponding to the components

feed zone of a components feeder, and passive circuit elements are received by them. In a components receipt location, a components holder is made to go up and down with a lifting device, and takes out passive circuit elements from a components feeder. After receiving all the passive circuit elements of a schedule, a components slewing gear is moved to up to a circuit base material by the migration equipment for conveyance, like the time of the receipt of passive circuit elements, while two or more components holders are moved to a components stowed position one by one, it is positioned in the location corresponding to the components wearing part of a circuit base material, it is made to go up and down with a lifting device, and a circuit base material is equipped with passive circuit elements. After a circuit base material is equipped with all the passive circuit elements that a holder slewing gear holds, a holder slewing gear is moved to a components feeder by the migration equipment for conveyance, and receives passive circuit elements again. According to the passive-circuit-elements wearing system concerning this invention, also in a system given in said JP,6-196546,A thus, similarly Two or more components holders are moved and passive circuit elements are taken out from a components feeder. In order that the effectiveness by equipping a circuit base material, i.e., effectiveness, such as a miniaturization of a system, may be acquired and a components holder may moreover equip reception and a circuit base material with passive circuit elements from a components feeder in the location where it was decided on the revolution locus, The distance between two components holders which the migration length of the holder slewing gear at the time of wearing gets mixed up like before, and equip with passive circuit elements is not included, but it is only the distance between two components wearing parts, is short, and can equip with passive circuit elements quickly. A lifting device in addition, saying "you make it go up and down a components holder in a components receipt location and a components stowed position at least" Only not only in the mode dropped to it after a components holder arrives at a components receipt location or a components stowed position and stops in this invention so that it may explain in the gestalt of implementation of invention The mode, components receipt location, and components stowed position which are made to start descent before descent and revolution of a components holder are performed in parallel and a components holder arrives at a components receipt location or a components stowed position mean that the mode which completely drops a components holder in another halt location is contained. A lifting device is good also as a thing which makes it go up and down a components holder directly, and good also as a thing which makes it go up and down the member holding a components holder. Moreover, the flat surface which inclined not only in the horizontal plane is sufficient as a "conveyance flat surface." A conveyance flat surface is prescribed by XY coordinate, the polar coordinate, etc., XY robot is sufficient as the migration equipment for conveyance, it is equipped with a rotation arm, the robot by which a migration location is specified by the polar coordinate may be used, and the equipment of various modes -- a surface stepping motor may be used -- can be further used for it. A surface stepping motor has a plane stator as indicated by JP,7-45995,A. A stator forms a magnetic path, for example, it has many salient poles while it is made with a magnetic material, and it is prepared in the whole successive range of a needle. two or more electromagnetism by which, as for the needle, the coil which makes a field was twisted around York, respectively -- a component -- having -- the electromagnetism of these plurality -- a needle is moved to the location of the arbitration within a flat surface parallel to a stator by exciting a component alternatively. Therefore, if the migration member for conveyance is attached in a needle (good also considering the needle itself as a migration member for conveyance), a holder slewing gear can be moved to the location of the arbitration within a conveyance flat surface. If a surface stepping motor is used, the function in which a stator guides migration of the migration member for conveyance will be achieved, and if a stator is just going to be, it can move anywhere. When two or more holder slewing gears are formed so that it may mention later especially, there is no interference of the guide apparatus holding each holder slewing gear of the migration member for conveyance, the degree of freedom of migration of two or more holder slewing gears becomes high, and fetch of the passive circuit elements from a components feeder and the degree of freedom of wearing to a circuit base material become high, and become possible [equipping with passive circuit elements efficiently]. It can become possible to also make two holder slewing gears equip a coincidence term with passive circuit elements at one circuit base material, and it can also set the number of holder slewing gears or more to three if needed. A components adsorption implement is sufficient as a components holder, and the components grasping implement which grasps passive circuit elements by two or more grasping members is sufficient as it so that it may mention later. With a grasping member switchgear, it is made to open and close two or more grasping members of each other by the symmetry, and they grasp and release passive circuit elements. A lifting device may make it go up and down a components holder directly, and may make it go up and down the member which holds a components holder.

[0007] A holder slewing gear makes the components receipt stowed position which is also a components receipt location or a components maintenance location a sequential halt of two or more components holders carried out, and a lifting device makes it go up and down each part article holder in the components receipt stowed position in the passive-circuit-elements wearing system concerning the 1st invention in the 2nd invention at least. If a components receipt location and a components maintenance location are carried out in common, the number of lifting devices can be reduced and reduction of equipment cost will be attained. Moreover, since bearing of passive circuit elements does not change at the time of a components receipt and components wearing, there is no need for amendment of bearing by a components receipt location differing from a components stowed position like before, and a circuit base material can be equipped with passive circuit elements easily and quickly.

[0008] In the 3rd invention, while having a components feeder on every two one both sides of the circuit base material supporting structure, the passive-circuit-elements wearing system concerning the 1st or 2nd invention While having two sets of wearing units containing two or more components holder, holder slewing gears, migration equipment for conveyance, lifting devices, and receipt wearing control units and making two components feeders and the circuit base material supporting structure stand it still during wearing at least A control unit makes one side of a two-set wearing unit receive passive circuit elements from one side of two components feeders, and makes it equip a circuit base material. The mutual wearing control means which makes another side of a wearing unit receive passive circuit elements from another side of a components feeder, and makes it equip the same circuit base material, and makes the receipt of passive circuit elements and wearing perform to a these two sets wearing unit by turns to it shall be included. In the passive-circuit-elements wearing system concerning this invention, while one side of the two-set wearing units has equipped the circuit base material with passive

circuit elements, another side starts wearing of passive circuit elements immediately from a components feeder after reception and wearing termination of passive circuit elements according [another side] passive circuit elements to one side. If one set of wearing units is prepared, while the components holder has received passive circuit elements from the components feeder, wearing is not performed, but to being useless, wearing is absent from almost, and is performed that there is nothing, and it can equip with passive circuit elements well. Moreover, a components feeder is easy to move one holder slewing gear to a components feeder, avoiding interference of two holder slewing gears, and to move the holder slewing gear of another side to a circuit base material, since it is prepared in every one both sides of the circuit base material supporting structure, and a system with easy design of the migration equipment for conveyance and creation of a wearing program is obtained. the class of passive circuit elements which each of two components feeders supplies -- being the same -- you may differ. Anyway, two wearing units equip one circuit base material with passive circuit elements jointly. If the class of passive circuit elements to supply is the same, there is an advantage which is not necessarily asked about from any of two wearing units wearing is started. Moreover, while dividing into two components feeders and giving even if there are many classes of passive circuit elements if the classes of passive circuit elements which each part article feeder of two wearing units holds differ, by arranging in the both sides of a circuit base material, as compared with the case where a large-sized components feeder with many classes of passive circuit elements to hold is prepared in one circuit base material side, a system can be packed into a compact and can be formed. In addition, it must not necessarily be adopted by preparing two components feeders and preparing 2 sets of wearing units together, whenever it adds, and two or the passive-circuit-elements wearing system formed 2 sets may also have only either as an embodiment of the 1st or 2nd invention.

[0009] In the passive-circuit-elements wearing system which the 4th invention requires for any one of the 1st thru/or the 3rd invention (a) Image pick-up equipment which is held in the condition of countering the migration member for conveyance at the passive circuit elements held at the components holder, and picturizes passive circuit elements, (b) Based on the image of the passive circuit elements acquired by the image pick-up equipment, the maintenance position error of the passive circuit elements by the components holder is acquired. Let it be a summary to have established a positioning amendment means to amend positioning to the circuit base material supporting structure of the holder slewing gear by the migration equipment for conveyance based on the maintenance position error. In this system, while passive circuit elements are picturized, a maintenance position error is amended and it is equipped with passive circuit elements with a precision sufficient in the components wearing part of a circuit base material. Since image pick-up equipment is held at the migration member for conveyance and moves with a holder slewing gear, improvement in the speed of components wearing can be attained securing time amount possible picturizing in parallel to the receipt of passive circuit elements and required for calculation of the maintenance position error based on an image pick-up result. An image pick-up may be performed in the condition that passive circuit elements have stopped, and may be performed in the condition of moving. For example, it is possible to picturize image pick-up equipment also in the thing containing a high speed camera with a stroboscope or a line sensor, then the condition that passive circuit elements are moving. The high speed camera with a stroboscope irradiates and picturizes a light strong against passive circuit elements, when passive circuit elements pass. although passive circuit elements are moving, or it enlarges shutter speed extremely -- lighting time amount -- **** — by shortening, passive circuit elements can be picturized as if it was standing it still. A line sensor has many image sensors arranged in in the shape of a straight line, is formed with the posture prolonged for a long time in radial [of the circle centering on the fixed pivot line of a components holder], and picturizes passive circuit elements for every fixed time amount. An image pick-up is performed in the condition that a components holder moves at uniform velocity, and when the image of every one line of passive circuit elements is divided, and is picturized in the migration direction and passive circuit elements finish passing a line sensor, the data of the overview of passive circuit elements are obtained. The two-dimensional image of passive circuit elements is obtained by the repetition of an image pick-up and the migration of a components holder by the line sensor. However, since the components holder is rotating and the include angles to the line sensor of passive circuit elements differ for every image pick-up, it is required to constitute a two-dimensional image in consideration of change of this include angle.

[0010] In the passive-circuit-elements wearing system concerning any one of the 1st thru/or the 4th invention, while a components holder is held pivotable by the holder slewing gear at the circumference of the axis of a components holder, the 5th invention The holder slewing gear which makes the migration member for conveyance rotate a components holder around the axis of the components holder is held. And the image pick-up equipment with which the circuit base material wearing system concerned is held in the condition of countering the migration member for conveyance at the passive circuit elements held at the components holder, and picturizes passive circuit elements, A bearing amendment means to acquire the maintenance bearing error of the passive circuit elements by the components holder based on the image of the passive circuit elements acquired by the image pick-up equipment, to control a holder slewing gear based on the maintenance bearing error, and to amend a maintenance bearing error shall be included. In this system, the maintenance bearing error of the passive circuit elements by the components holder is amended, and a circuit base material is equipped with passive circuit elements in the exact bearing. A holder slewing gear is good also as what rotates two or more components holders all at once, or good also as a thing which makes it rotate separately so that it may explain in the gestalt of implementation of invention. Finally a holder slewing gear is held at the migration member for conveyance, as long as it is movable with it, is good, for example, may be held at the holder slewing gear. Moreover, it not only amends a maintenance bearing error, but you may change maintenance bearing of passive circuit elements into bearing set up beforehand with a holder slewing gear.

[0011] In the passive-circuit-elements wearing system which the 6th invention requires for the 4th or 5th invention Furthermore, by being prepared possible [rise and fall] with each part article holder to each of the cam member equipped with the cam side where the height formed along with the revolution locus of the components holder of (a) plurality changes, and the components holder of (b) plurality, and engaging with a cam side Let it be a summary to have prepared the cam follower which makes it go up and down a components holder with revolution of a components holder, and to have arranged image pick-up equipment in the location corresponding to a part higher than the part at least corresponding to one side of the components receipt location of a cam side, and a components stowed position. In this system, while two or more components holders are revolved by the holder slewing gear, it is made to go up and down by a cam and the cam follower,

and image pick-up equipment is arranged in the clearance formed by that cause. A components receipt and rise-and-fall distance at the time of wearing can be made small, avoiding interference with interference with passive circuit elements and the image pick-up equipment, components feeder, and circuit base material which were held at image pick-up equipment, a components holder, and it, if it puts in another way. Although the end cam and spherical cam follower which are explained in the gestalt of implementation of invention from a viewpoint of simplification and a miniaturization as a cam member and a cam follower are suitable, it is good also as a grooved cam, a protruding line cam, a roller, etc. In addition, although "height" expresses the location of the object in a perpendicular direction, and it can usually say that the height of two or more components holders changes with change of the height of a cam side when the fixed pivot line of two or more components holders is perpendicular, a fixed pivot line may be made to incline to a conveyance flat surface so that it may mention later. In this case, although the distance from the top-most vertices of that conical surface shall change on the conical surface [side / of a cam member / cam] centering on a fixed pivot line and a components holder is made to move in the direction parallel to each bus-bar of a conical surface along a cam side, also suppose change of the location of this components holder that it is thought that it is change of height.

[0012] The cam member equipped with the cam side where the height formed in the passive-circuit-elements wearing system which the 7th invention requires for any one of the 1st thru/or the 6th invention along with the revolution locus of further two or more (alpha) components holders changes, (beta) By being prepared possible [rise and fall] with each part article holder to each of two or more components holders, and engaging with a cam side Let it be a summary to have prepared the cam follower which makes it go up and down a components holder with revolution of a components holder, and to have set at least one side of a components receipt location and a components stowed position as the location corresponding to the lowest part of a cam side. While a components holder is revolved by the holder slewing gear in this system, other components holders can be maintained at a high location, being made to go up and down by a cam member and the cam follower, making small rise-and-fall distance of the components holder at least in one side of a components receipt location and a components stowed position, and shortening time amount which at least one side of a receipt and wearing takes. If all components holders are in the same height, all the components holder of them The passive circuit elements with which a components feeder, the circuit base material supporting structure, and a circuit base material were already equipped, It is necessary to make it become higher than the highest part among a components holder and the part which may counter, and sets at least to one side of a components receipt location and a components stowed position. It will not be able to bring close to the components wearing part of the components feed zone of a components feeder, or a circuit base material enough, but the rise-and-fall distance for a components receipt or wearing will become large. One [at least] components holder of a components receipt location and a components stowed position can be brought enough close to a components feed zone or a components wearing part, avoiding that other components holders interfere with a components feeder and the circuit base material supporting structure, since it can maintain at a high location to it except the components holder of a components receipt location and a components stowed position which reaches on the other hand at least, and is in the near according to this invention.

[0013] The 8th invention the holder slewing gear of the passive-circuit-elements wearing system concerning any one of the 4th thru/or the 7th invention It should have the intermittent body of revolution which carries out fixed include-angle [every] intermittent rotation, and holds two or more components holders at include-angle spacing of the integral multiple of the intermittent angle of rotation. Image pick-up equipment is formed in one of two or more of the halt locations of the components holder by halt of intermittent body of revolution, make the halt location into a components image pick-up location, and let it be a summary to have set the components receipt location and the components stowed position as a different halt location from the components image pick-up location. In this system, the passive circuit elements of a idle state are picturized with image pick-up equipment, it is possible to perform that image pick-up in parallel to the receipt of other passive circuit elements or wearing moreover, and wearing efficiency can be raised. Not only one kind but arrangement include-angle spacing of a components holder can be changed into two or more kinds. A holder slewing gear is good as what has the driving source (for example, electric motors, such as a servo motor) of dedication in order to rotate intermittent body of revolution, so that it may explain in the gestalt of implementation of invention, and it is good also as what rotates intermittent body of revolution with the driving force of the driving source transmitted by the movement inverter which shares other equipment (for example, lifting device) and driving sources, and contains a cam and a cam follower. The driving force of a driving source is changed into rise-and-fall movement of a lifting device by the movement inverter containing another cam, a cam follower, etc. If the driving source of dedication is prepared, it becomes possible for you to revolve hard flow in the components holder which arbitration can make carry out include-angle rotation of the intermittent body of revolution, for example, equips the 1st with passive circuit elements, and to make it located in a components receipt location or a components stowed position with the shortest angle of rotation etc., and it can equip with passive circuit elements well. Moreover, even if the class of components holder prepared in intermittent body of revolution changes, arrangement spacing of a components holder changes and intermittent angle of rotation changes, it can respond easily. Moreover, two or more components holders are set on the whole place periphery centering on axis of rotation of intermittent body of revolution so that it may explain in the gestalt of implementation of invention. Without enlarging the path of intermittent body of revolution as compared with the case where it is made to hold to a radial to axis of rotation, if it is made to hold in parallel with axis of rotation, the number of maintenance of a components holder can be made [many], intermittent angle of rotation can be small, the time amount which intermittent rotation takes can be short, and wearing efficiency can be raised.

[0014] In the passive-circuit-elements wearing system concerning the 8th invention, while rotating two or more components holders all at once, the 9th invention a holder slewing gear Where some passive circuit elements which all the passive circuit elements by which what is received by these components holder is planned were received, and were held by these components holder are picturized by image pick-up equipment, the passive-circuit-elements wearing system concerned The migration equipment for conveyance is made to move a holder slewing gear to the circuit base material upper part, and let it be a summary to include the concurrency image pick-up control means which makes passive circuit elements picturize to image pick-up equipment in parallel to making the components holder which is in a lifting device in a components stowed

position equip with passive circuit elements. When the receipt of passive circuit elements and an image pick-up are performed in parallel along with intermittent rotation of intermittent body of revolution and all the passive circuit elements by which what is received by the components holder is planned are received since it is separated from the components receipt location and the image pick-up location, about the passive circuit elements located between a components receipt location and an image pick-up location, the image pick-up is not yet performed. After picturizing also about these passive circuit elements, it is also possible to start wearing of passive circuit elements, but if an image pick-up is made to perform in parallel to wearing, only the part to which a concurrency image pick-up is performed can shorten the time amount which wearing of all passive circuit elements takes. The case where passive circuit elements are held at two or more components holders of all, and a holder slewing gear is moved to the circuit base material upper part by horizontal migration equipment immediately after that is the most effective.

[0015]

[Supplementary information of invention] Besides a mode given in each above-mentioned claim, the following mode can carry out this invention. The mode of operation is indicated as an embodiment term of the same format as a claim for convenience. However, the embodiment term which is further subordinate to the embodiment term subordinate to two or more claims or embodiment terms shall not restrict that it can read about all the claims of these plurality, or embodiment terms, but shall be read only about the term which does not produce conflict logically.

(1) Claim 1 to which said components holder equips the lower limit of a shank and its shank with the components attaching part holding passive circuit elements thru/or the passive-circuit-elements wearing system of any one publication of nine. Said holder slewing gear mutually-independent around said fixed pivot line (2) Two or more rotatable rotation members, While going around said fixed pivot line to the rotation member of these plurality, respectively, one halt or more is included in it between the round. And it has rotation movement grant equipment which gives rotation movement which has fixed time difference mutually. A passive-circuit-elements wearing system given in the embodiment term 1 by which each shank of two or more of said components holders was held movable to shaft orientations at each of the attaching part formed in the equidistant location from said fixed pivot line at each of these rotation member, respectively. It is also possible to prepare the migration member which held the components holder and was held movable in the direction parallel to the axis of a components holder at the rotation member. In this case, a components holder is made to move in the direction parallel to an own axis by migration of a migration member. If it considers as the maintenance hole which formed the attaching part in the rotation member and a components holder is fitted into a maintenance hole pivotable, a components holder can be rotated around the axis, maintenance bearing of passive circuit elements can be changed, and a maintenance bearing error can be amended. Thus, the holder slewing gear equipped with two or more rotation members which hold a components holder, respectively and are rotated mutually-independent is indicated by the specification of Japanese Patent Application No. No. 342430 [seven to] by these people. Rotation movement grant equipment has the cam follower prepared to each of two or more rotation members, respectively, and at least one rotation movement grant cam which rotates each rotation member by carrying out sequential engagement and moving a cam follower to these cam followers contained. A rotation movement grant cam desirably the radii centering on said fixed pivot line It considers as the hard drum form cam which uses as a peripheral face the locus which the radii draw when it is made to rotate around the axis which intersects the fixed pivot line and right angle in two levels, while being located in the opposite side with said fixed pivot line to the radii. The set of the intersection of the one flat surface and each peripheral face of the hard drum form cam of these plurality in which two or more hard drum form cams are arranged in by axial symmetry by setting a symmetry axis as the fixed pivot line of two or more components holders, and contain all the axes of the hard drum form cam of these plurality has the whole place periphery which continued substantially drawn.

(3) A passive-circuit-elements wearing system given in the embodiment term 1 equipped with the body of revolution by which each shank of two or more of said components holders was held movable to shaft orientations at each of the attaching part prepared in the equidistant location from the fixed pivot line while said holder slewing gear was rotated by the surroundings of said fixed pivot line. [two or more] Also in this mode, it is possible to prepare the migration member which held the components holder and was held movable in the direction parallel to the axis of a components holder at body of revolution. In this case, a components holder is made to move in the direction parallel to an own axis by migration of a migration member. If an attaching part is used as a maintenance hole and a components holder is fitted into a maintenance hole pivotable, a components holder can be rotated around the axis, maintenance bearing of passive circuit elements can be changed, and an error can be amended.

(4) A passive-circuit-elements transport device given in the embodiment terms 2 or 3 in which said conveyance flat surface and said fixed pivot line crossed at right angles, and said attaching part was formed in parallel with a fixed pivot line.

(5) A passive-circuit-elements transport device given in the embodiment terms 2 or 3 toward which said two or more attaching parts are formed considering each of two or more bus-bars of the conical surface which uses said fixed pivot line of said body of revolution as a center line as a center line, and said fixed pivot line was made to incline to the perpendicular to said conveyance flat surface only at the include angle which will be in the condition that said conveyance flat surface and one bus-bar of said conical surface cross at right angles. If a conveyance flat surface is an inclined plane, it will be made to go up and down in the system of modes 4 or 5 along with the axis with which the components holder also inclined. A circuit base material inclines and is held, if a components feeder inclines and is prepared, by making it go up and down a components holder along with the inclined axis, a right angle can be approached, and can be made to be able to estrange to a components feeder or a circuit base material, and the receipt of passive circuit elements and wearing can be performed smoothly. In the system of a mode 5, the height (distance with a conveyance flat surface) of a components holder can be changed with rotation of body of revolution, and the effectiveness of being able to arrange image pick-up equipment in the clearance between the vertical directions is acquired. Moreover, even if it prepares neither a cam member nor a cam follower, the height of a components holder is changeable, there can be few components mark, and can end, passing speed of the holder slewing gear migration mass is small and according to the migration equipment for conveyance can be made high, and wearing efficiency can be raised.

(6) While being arranged above the revolution locus of said components holder, said cam member The inferior surface of tongue of a cam member is made into the cam side where height changes, and said cam follower is held pivotable in all the directions at the upper limit of said shank. Claim 6 including an energization means to be a spherical cam follower rolling on said cam side top, and to energize said components holder toward said cam member thru/or 9, the embodiment term 1, or the passive-circuit-elements wearing system of any one publication of five. Since the spherical cam follower may turn to any direction when moving along a cam side, Like equipment using a roller as a cam follower that what is necessary is just to make it hold pivotable in all the directions to the upper limit of the shank of a components holder It is not necessary to prepare the supporter material which relative rotation is impossible and supports a roller to the member holding the support shaft and components holder which support a roller pivotable, and the configuration of a holder slewing gear can be simplified. Consequently, effectiveness, such as passing speed improvement in the speed by reduction of the mass of the member which moves with the member holding the cost reduction by reduction of components mark and a components holder, is acquired. Moreover, in order that a spherical cam follower may roll a cam side top, the cam follower to which external surface constitutes the shape of a semi-sphere side is prepared in the upper limit section of the shank of a components holder in one, there are few sliding frictions as compared with the case where it is made to move along a cam side, and it ends, and there is little wear and the long equipment of a life is obtained. A spherical cam follower permits rotation of a components holder, when it can be suitable in every direction and a components holder is rotated by the surroundings of an own axis. If a cam follower must decide the direction of axis of rotation to be one like a roller when rotating a components holder A cam follower cannot be made to hold to a components holder. Apart from a components holder a cam follower As opposed to having to prepare the member held where the direction of the axis of rotation is decided to be one While being able to make a direct cam follower able to hold to a components holder, being able to change height into a revolution loous and rotating a components holder, a holder slewing gear simple [a configuration] and cheap is obtained.

(7) A passive-circuit-elements wearing system given in the embodiment term 6 containing the rise-and-fall driving gear which makes it go up and down the rise-and-fall driving member by which notching was formed in the part corresponding to said components receipt stowed position of said cam member, and fitting of the rise and fall of said lifting device was made possible to it at the notching, and its rise-and-fall driving member between the rise location where the inferior surface of tongue of that follows said cam side, and the downward location in which an inferior surface of tongue is caudad located from a cam side. A rise-and-fall driving member is in a rise location except the time of rise and fall of a components holder, and a cam follower moves along a cam side and engages with the inferior surface of tongue of a rise-and-fall driving member. If a rise-and-fall driving member is dropped in this condition, a components holder will be dropped, and if a rise-and-fall driving member is raised, a components holder will follow a rise-and-fall driving member according to the energization force of an energization means, and will be raised, and it will return to the location where a cam follower engages with a cam side. When a maintenance slewing gear stops the location where the components holder was beforehand defined on the revolution locus of that and a rise-and-fall driving member is prepared in the halt location, a rise-and-fall driving gear After a components holder is stopped by the halt location, it is good also as what drops a rise-and-fall driving member, and in at least one side of halt location before and back, it is good also as what drops a rise-and-fall driving member after the cam follower has engaged with the rise-and-fall driving member. At least one side of the descent for revolution of a components holder, the receipt of passive circuit elements, and wearing and a rise is made concurrent in the case of the latter, and it can shorten the time amount of the activity done with rise and fall of a components holder.

(8) A passive-circuit-elements wearing system given in the embodiment term 7 currently held possible [evacuation in the evacuation location which does not bar migration of a components holder when the force beyond the set point is applied in the revolution direction of said components holder in said downward location] although said rise-and-fall driving member is in said lifting device in the operation location which can fit into said notching at a usual state.

(9) A passive-circuit-elements wearing system given in the embodiment term 8 which said rise-and-fall driving member is held rotatable in the location from which it separated to the side at the circumference of a perpendicular axis from the revolution locus of said components holder, and evacuates to said lifting device by the rotation in said evacuation location. Strictly, a rise-and-fall driving member is held rotatable at the circumference of a perpendicular axis at the output member of a rise-and-fall driving gear, engages with a components holder in the part which separated from the perpendicular axis, and is rotated to an evacuation location. Although it is also possible to move a rise-and-fall driving member to an evacuation location by the parallel displacement, the direction depended on rotation can simplify maintenance structure of the rise-and-fall driving member by the rise-and-fall driving gear, and the purpose can be attained cheaply.

(10) The embodiment term 7 containing the stopper which said lifting device resists the energization force of an energization means to energize said rise-and-fall driving member toward said operation location, and its energization means, and maintains at an operation location thru/or the passive-circuit-elements wearing system of any one publication of nine.

(11) A passive-circuit-elements wearing system given in the embodiment term 10 in which said stopper contains the stopper member which was attached in the attachment component held possible [rise and fall of said rise-and-fall driving member] possible [centering control], and which can be adjusted.

(12) The embodiment term 7 currently formed in the depth in which said notching of said cam member can pass said spherical cam follower thru/or the passive-circuit-elements wearing system of any one publication of 11.

(13) The embodiment term 8 including the migration detection equipment which detects further the migration which goes to said evacuation location of said rise-and-fall driving member, and emits a detection signal, and the revolution means for stopping which stops revolution of said holder slewing gear according to the detection signal of the migration detection equipment thru/or passive-circuit-elements wearing system of any one publication of 12. You may make it stop revolution of a components holder by detecting migration in the downward location in stages other than the time of rise and fall of a rise-and-fall driving member instead of detecting the migration which goes to the evacuation location of a rise-and-fall driving member.

(14) Claim 1 which is the components adsorption implement which said components holder adsorbs said passive circuit elements with negative pressure, and is held thru/or 9, the embodiment term 1, or the passive-circuit-elements wearing

system of any one publication of 1.3. If passive circuit elements are adsorbed with negative pressure and held, it can hold without a possibility of damaging passive circuit elements. Moreover, while the configuration of a components holder becomes simple, maintenance of passive circuit elements and control of release become easy, and it becomes easy [the image pick-up of the passive circuit elements held further at the components holder].
(15) Passive-circuit-elements transport device given in the embodiment term 1.4 which contains in a components adsorption implement further the pressure controller to which adsorption of passive circuit elements and release are made to perform by controlling the pressure in said components adsorption implement.
(16) While being operated by the pressure change-over valve equipped with the change-over member to which said pressure controller is held at said holder slewing gear, and switches the pressure in said components adsorption implement, and the lifting device which makes it go up and down said components holder It follows on the rise-and-fall driving member which makes it go up and down said components adsorption implement of a lifting device dropping a components adsorption implement. The adsorption implementation condition of moving said change-over member to the negative pressure supply location where said pressure change-over valve switches the pressure in said components adsorption implement to negative pressure from the pressure more than atmospheric pressure, It follows on said rise-and-fall driving member dropping a components adsorption implement. A passive-circuit-elements transport device given in the embodiment term 15 which contains the change-over valve control unit which can be switched in the release implementation condition moved to the negative pressure discharge location where a pressure change-over valve switches the pressure in a components adsorption implement for a change-over member to the pressure more than atmospheric pressure from negative pressure. At the time of adsorption of passive circuit elements, a rise-and-fall driving member synchronizes with dropping a components adsorption implement mechanically, the change-over member of a pressure change-over valve is moved to a negative pressure supply location, a pressure change-over valve switches the pressure in an adsorption implement to negative pressure from the pressure more than atmospheric pressure, and a components adsorption implement adsorbs passive circuit elements. At the time of release of passive circuit elements, a rise-and-fall driving member synchronizes with dropping a components adsorption implement mechanically conversely, the change-over member of a pressure change-over valve is moved to a negative pressure discharge location, a pressure change-over valve switches the pressure in an adsorption implement to the pressure more than atmospheric pressure from negative pressure, and a components adsorption implement releases passive circuit elements. A pressure change-over valve is alternatively switched to either of two conditions with descent of the rise-and-fall driving member of one lifting device in the same location. According to this mode, rise and fall of a components adsorption implement, and supply of negative pressure and the change of discharge synchronize mechanically, and are performed, descent of a components adsorption implement, rise timing, and supply of negative pressure and discharge timing do not shift, and generating of an adsorption mistake or a wearing mistake is avoided good. Moreover, adsorption of passive circuit elements and wearing are performed in the same location, and the driving source for switching a pressure change-over valve can be managed with one, and can constitute equipment cheaply. A rise-and-fall driving member is good also as a thing which itself goes up and down [thing] and makes it go up and down a components adsorption implement, and good also as a thing which you move [thing] in the direction which is not parallel to the rise-and-fall direction of a components adsorption implement in itself, and makes it go up and down a components adsorption implement through movement inverters, such as a cam mechanism and a link mechanism. Moreover, you may make it a rise-and-fall driving member move a change-over member by own migration, or may make it move a change-over member through other members.
(17) Two migration members for a change-over which said change-over valve control unit moves to the reverse sense by synchronizing mechanically with rise and fall of said components adsorption implement, Two actuators which make the operation member which is prepared in each of the migration member for these change-overs, and acts on said change-over member from the opposite side mutually displaced relatively to each migration member for a change-over, A passive-circuit-elements wearing system given in the embodiment term 16 containing the bitter taste tutor control unit controlled so that every [of said two operation members / one side] acts on said change-over member alternatively with these two actuators at migration of said two migration members for a change-over. Straight-line migration of the migration member for a change-over shall be carried out, and it is good also as what carries out straight-line migration of the operation member to the migration member for a change-over in the direction which is good also as what carries out straight-line migration in the parallel direction, or crosses. Moreover, while using the migration member for a change-over as a rotation member, it is good also as a rotation member which can prepare an operation member in the surroundings of the same rotation axis as the rotation axis of the migration member for a change-over rotatable, and draws the same rotation locus. The migration direction of the migration member for a change-over can also be considered [also making it parallel with the migration direction of a rise-and-fall driving member, or] as directions [**** / un-], such as a direction which intersects perpendicularly, for example, although it is possible. It may not be indispensable to also make the migration direction of a change-over member parallel with the migration direction of a rise-and-fall driving member or an operation member, and rectilinear motion or rotation is sufficient as migration of a change-over member. That to which an actuator also operates linearly may also operate by rotation.
(18) A passive-circuit-elements wearing system given in the embodiment term 17 made to cooperate by the transport unit with which another side makes reverse the migration direction of a rise-and-fall driving member, and which said change-over member moves to said negative pressure supply location and said negative pressure discharge location by rise and fall, one side of said two migration members for a change-over goes up and down in one with said rise-and-fall driving member, and it delivers it by the rise-and-fall driving member. Although it is also possible for two migration members for a change-over to be displaced relatively to both rise-and-fall driving members, the thing which moves one side of the migration member for a change-over in one with a rise-and-fall driving member, then a change-over valve control unit can be constituted easily.
(19) A passive-circuit-elements wearing system given in the embodiment terms 17 or 18 in which said change-over valve control unit contains at least one auxiliary actuator which makes the corresponding operation member displaced relatively to the migration member for a change-over at said actuator and serial as a main actuator between said operation members

corresponding to at least one side and one side of said two migration members for a change-over. When both the main actuator and an auxiliary actuator can take two operating states and one auxiliary actuator is formed, while being moved to the operation location where an operation member acts on a change-over member with the main actuator, and the non-acting location which does not act, the operation location of an operation member is changed into two steps by the subactuator. If two or more subactuators of each other are formed in a serial, modification on a multistage story will be attained in the non-acting location of an operation member. For example, if the height at the time of a components adsorption implement adsorbing passive circuit elements and the height at the time of releasing may change according to the height of passive circuit elements, by setting up the change-over stage of a pressure change-over valve according to the height, passive circuit elements can be adsorbed, or can be released at a more suitable stage, and conveyance efficiency can be raised. Any may be prepared in an operation member side that the main actuator and the auxiliary actuator of each other should just be formed in a serial. An auxiliary actuator shall also be rotated [also operating linearly and].

(20) The positive pressure supply path which supplies positive pressure to said components adsorption implement through a change-over member is established in one side of said operation member, and they are the embodiment term 17 of said release implementation condition by which positive pressure is supplied at least to said components adsorption implement in the first stage thru/or the passive-circuit-elements wearing system of any one publication of 19.

(21) The embodiment term 17 by which the relative-displacement permission equipment permitted giving elastic drag force was formed [that an operation member is displaced relatively to the migration member for a change-over, and] between said migration members for a change-over of said operation member when the actuation load given to an operation member by the migration member for a change-over exceeded the set point thru/or the passive-circuit-elements wearing system of any one publication of 20. In order to switch a pressure change-over valve certainly by the shortest possible actuation stroke of a change-over member, it is desirable in making relative-displacement permission equipment absorb the excessive stroke of the migration member for a change-over after forming the stopper which prevents migration of a change-over member in a negative pressure supply location and a negative pressure discharge location and preventing migration of a change-over member by the stopper.

(22) The positive pressure supply path in which the operation member in which said positive pressure supply path was established is formed ranging over these operations member and a change-over member in the condition of having contacted said change-over member, It is prepared in the part intercepted from said components adsorption implement and the source of negative pressure in the condition that said pressure change-over valve is in a negative pressure supply condition. A passive-circuit-elements transport device given in the embodiment terms 20 or 21 in which an outflow permissible means to approve extracting that a gas flows out of a positive pressure supply path into atmospheric air to the outflow gas, and giving effectiveness was formed.

(23) A passive-circuit-elements transport device given in the embodiment term 22 in which said outflow permissible means includes the free passage way formed in the condition that the operation member makes the operation member in which said positive pressure supply path was established open a positive pressure supply path for free passage to atmospheric air also in the condition of having contacted said change-over member.

(24) A passive-circuit-elements transport device given in the embodiment terms 22 or 23 by which the variable-aperture means was formed at least in one side with the part of the upstream from said outflow permissible means and an outflow permissible means of a positive pressure supply path by which said operation member is formed ranging over these operations member and a change-over member in the condition of having contacted the change-over member. By accommodation of a variable-aperture means, the amount of flush of the pressure gas from the components adsorption implement after the pressure increase in a components adsorption implement can be adjusted, or the ratio of the flow rate of the pressure gas to the components adsorption implement after the pressure increase immediately after a change-over in the negative pressure discharge condition of a pressure change-over valve and in a components adsorption implement can be adjusted.

(25) Said components holder is held by said holder slewing gear movable [to shaft orientations] pivotable to the circumference of the axis of a components holder. And the driver which the passive-circuit-elements wearing system concerned is formed in this alignment to said fixed pivot line, and arbitration is made to carry out include-angle rotation further by the driving source, It is fixed to each of said components holder by this alignment, and said driver and two or more blown driven gears are included. And claim 1 which is that at which said driver and said driven gear maintain an interlocking condition irrespective of shaft-orientations migration of said components holder by said lifting device thru/or 9, the embodiment term 1, or the passive-circuit-elements wearing system of any one publication of 24. They will constitute the holder slewing gear made to rotate a components holder all at once, a driving source, a driver, a driven gear, etc. permitting migration of the shaft orientations of each part article holder.

(26) A passive-circuit-elements wearing system given in the embodiment term 25 said driver is [width of face] larger than said driven gear. Although the purpose may be attained also by making a driven gear into what has width of face larger than a driver, according to this mode, the characteristic effectiveness that the migration tooth space of a driven gear required [that what is necessary is just to make one gearing's width of face large] in order to enable shaft-orientations migration of a components holder is small, and ends is acquired.

(27) The Maine conveyor further positioned and supported while conveying a circuit base material, At least one side with the taking-out conveyor which receives and takes out a circuit base material from the carrying-in conveyor which conveys a circuit base material and is handed over on the Maine conveyor, and the Maine conveyor is included. And while arranging said Maine conveyor in the direction right-angled in the conveyance direction of said circuit base material at two or more juxtaposition At least one side of said carrying-in conveyor and taking-out conveyor Claim 1 containing the conveyor shifter alternatively shifted to two or more of these shift positions in which one side is connected with each of two or more Maine conveyors even if few thru/or 9, the embodiment term 1, or the passive-circuit-elements wearing system of any one publication of 26. The Maine conveyor has the conveyance function and positioning support function of a circuit base material, and the part which positions and supports a circuit base material constitutes the circuit base material supporting

structure. A carrying-in conveyor can carry in a circuit base material to both reception and two or more Maine conveyors in the location of the arbitration of two or more shift positions, when shifted by the conveyor shifter. When a taking-out conveyor is shifted by the conveyor shifter, either of two or more Maine conveyors can also take out a circuit base material for a circuit base material in the location of the arbitration of reception and two or more shift positions. After wearing of the passive circuit elements to the circuit base material which two or more Maine conveyors are formed and was supported by one Maine conveyor, Wearing of the passive circuit elements to the circuit base material immediately supported by Maine conveyor of another side can be started. The shifting time of a circuit base material is 0 substantially, a circuit base material can be carried in and taken out on two or more Maine conveyors by every one carrying-in conveyor and taking-out conveyor, and a passive-circuit-elements wearing system with an easy configuration is obtained highly [working capacity]. Both a carrying-in conveyor and a taking-out conveyor may be formed, and may prepare only either. For example, the work device which does a certain activity to a circuit base material is put in order by two or more serials, and the Rhine-like activity system is constituted. If the circuit base material with which the passive-circuit-elements wearing system concerning this mode is formed in the style of [of Rhine] the lowest, and the activity ended is contained by receipt equipments, such as a stocker It is possible to take out from the Maine conveyor by the robot or the operator, and to contain to receipt equipment, and taking out by the taking-out conveyor is not indispensable. In such a system, although only a carrying-in conveyor will be formed, a circuit base material can be handed over alternatively [two or more Maine conveyors] to one by one carrying-in conveyor. Moreover, if the passive-circuit-elements activity system of this mode is formed in the maximum upstream of a Rhine-like activity system, a circuit base material is set to the Maine conveyor by a robot, the operator, etc., or the circuit base material feeder, for example, has two or more substrate delivery sections and a circuit base material is handed over by each of two or more Maine conveyors, a carrying-in conveyor is not indispensable. Also in such a system, one taking-out conveyor can be shifted and a circuit base material can be alternatively taken out from two or more Maine conveyors.

(28) A passive-circuit-elements wearing system given in the embodiment term 27 which is that by which the wearing unit containing said two or more components holders, said holder slewing gear, said migration equipment for conveyance, said lifting device, and said receipt wearing control device can equip any of two or more of said Maine conveyors with passive circuit elements also to the circuit base material by which positioning support is carried out. If wearing of the passive circuit elements to the circuit base material by which positioning support is carried out is completed to one of two or more Maine conveyors, a wearing unit can start wearing of the passive circuit elements to the circuit base material which positioning support is immediately carried out at another Maine conveyor, and is standing by, and can equip with passive circuit elements well. Since it can equip with passive circuit elements also to the circuit base material on which Maine conveyor, it is good to even prepare one wearing unit, but if another wearing unit equips a circuit base material with passive circuit elements also while more than one are prepared and the components holder of some wearing units takes out passive circuit elements from a passive-circuit-elements feeder, a wearing unit does not need to interrupt wearing for drawing of passive circuit elements, and can equip with passive circuit elements well.

(29) Said Maine conveyor is arranged in 2 juxtaposition, and said components feeder is arranged by each method of an outside of these two Maine conveyors, respectively. Two wearing units containing said two or more components holders, said holder slewing gear, said migration equipment for conveyance, said lifting device, and said receipt wearing control unit are prepared. A passive-circuit-elements wearing system given in the embodiment term 27 with which these two wearing units equip the circuit base material by which conveys passive circuit elements above the thing of the arbitration of reception and said two Maine conveyors from each of said two components feeders, and positioning support is carried out at the Maine conveyor. Although it can equip with passive circuit elements without the futility of time amount if a wearing unit equips with passive circuit elements by turns by two, it is not indispensable to equip with passive circuit elements by turns. Even if it does not make it such, it is possible to supply the passive circuit elements of varieties from two for example comparatively small components feeders, and the effectiveness which can form the circuit which needs the passive circuit elements of varieties is acquired, avoiding increase of the migration length of a wearing unit.

(30) The embodiment term 27 in which the downstream equipment which receives a circuit base material from the upstream equipment which adjoins the criteria shift position as which said carrying-in conveyor was arranged in the upstream of said Maine conveyor, and said taking-out conveyor was arranged in the downstream, respectively, and it was beforehand determined of two or more of said shift positions of these carrying-in conveyor and a taking-out conveyor, respectively, and hands over a circuit base material on a carrying-in conveyor, and a taking-out side conveyor is arranged thru/or the passive-circuit-elements wearing system of any one publication of 29. There are for example, a circuit base material feeder, a passive-circuit-elements wearing system, a spreading system that applies adhesives and paste-like solder to a circuit base material in upstream equipment, and there are curing oven which stiffens for example, a passive-circuit-elements wearing system and the adhesives which are tacking carrying out of the passive circuit elements to the circuit base material, a reflow furnace which is made to carry out melting of the solder and connects passive circuit elements to a circuit base material electrically in downstream equipment. Since a circuit base material can be received also in any of two or more shift positions and, as for a carrying-in conveyor, a taking-out conveyor can hand over passive circuit elements also in any of two or more shift positions, Even if each circuit base material delivery location and receipt location of upstream equipment and downstream equipment are one and the location was decided in the shift direction of a carrying-in conveyor and a taking-out conveyor If three persons are connected for the shift position which is in agreement with each circuit base material delivery location of upstream equipment and downstream equipment, and a receipt location as a criteria shift position of the passive-circuit-elements wearing system concerned, a circuit base material can be delivered convenient.

(31) The embodiment term 27 by which said carrying-in conveyor was arranged in the upstream of said Maine conveyor, and said taking-out conveyor was arranged in the downstream, respectively thru/or the passive-circuit-elements wearing system of any one publication of 29. A carrying-in conveyor and a taking-out conveyor can function as a taking-out conveyor and a carrying-in conveyor, respectively, if the conveyance direction is made reverse with the Maine conveyor.

(32) The passive-circuit-elements wearing system by which the passive-circuit-elements wearing system given in the embodiment term 31 was arranged by at least two serial. In this passive-circuit-elements wearing system, delivery of a

circuit base material is performed between the taking-out conveyor of the passive-circuit-elements wearing system of the upstream, and the carrying-in conveyor of the passive-circuit-elements wearing system of the downstream. A taking-out conveyor and carrying-in conveyor can also make it shift to two or more shift positions alternatively, and delivery of a circuit base material is performed in one of the arbitration of two or more shift positions. It is not necessary to decide the shift position to which delivery of a circuit base material is performed to be one, and can determine according to the percentage of completion of wearing of two adjoining passive-circuit-elements wearing systems, and the degree of freedom of a passive-circuit-elements wearing system improves.
(33) The embodiment term 27 by which the carrying-in taking-out conveyor which served both as said carrying-in conveyor and said taking-out conveyor was arranged in the upstream of said Maine conveyor thru/or the circuit base material activity system of any one publication of 29. A carrying-in taking-out conveyor can convey a circuit base material to the forward direction and hard flow, functions as a carrying-in conveyor in the condition of conveying in the forward direction, and functions as a taking-out conveyor in the condition of conveying to hard flow. This mode is effective when [with desirable discharging to the same side as the side to which the circuit base material was supplied] special.
(34) The embodiment term 30 in which said conveyor shifter contains the carrying-in conveyor shifter to which said carrying-in conveyor and said taking-out conveyor are shifted mutually-independent, and a taking-out conveyor shifter thru/or the passive-circuit-elements wearing system of any one publication of 32. The degree of freedom of the thing to which a conveyor shifter is independently shifted although it is also possible to shift a carrying-in conveyor and taking-out conveyors all at once, then a passive-circuit-elements wearing system improves.
(35) The embodiment term 27 in which said conveyor shifter contains the conveyor susceptor which supports at least one side of said carrying-in conveyor and taking-out conveyor, and the hydrostatic pressure cylinder to which the conveyor susceptor is shifted thru/or the passive-circuit-elements wearing system of any one publication of 34. If a hydrostatic pressure cylinder is used, the conveyor shifter to which a carrying-in conveyor and a taking-out conveyor may be shifted quickly can be manufactured cheaply.
(36) A passive-circuit-elements wearing system given in the embodiment term 35 said whose hydrostatic pressure cylinder is a rod loess cylinder arranged ranging over said two or more shift positions. If a rod loess cylinder is used, as compared with the case where the hydrostatic pressure cylinder equipped with the piston rod is used, a conveyor shifter can be constituted in a compact.
(37) The embodiment term 27 in which said conveyor shifter contains the conveyor susceptor which supports at least one side of said carrying-in conveyor and taking-out conveyor, and the driving gear to which a servo motor is shifted for the conveyor susceptor as a driving source thru/or the passive-circuit-elements wearing system of any one publication of 34.
(38) The embodiment term 27 containing the substrate positioning means for supporting with which said Maine conveyor floats and carries out positioning support of said circuit base material from a conveyance side thru/or the passive-circuit-elements wearing system of any one publication of 37. According to the equipment of this mode, a circuit base material can be positioned certainly.
(39) A passive-circuit-elements wearing system given in the embodiment term 38 which said two or more Maine conveyors are equipped with the conveyor belt conveyed in support of a circuit base material, respectively, and are driven all at once by the belt driving source with the common conveyor belt of the Maine conveyor of these plurality. If substrate positioning means for supporting float and carry out positioning support of the circuit base material from a conveyance side, even if it operates the conveyor belts of two or more Maine conveyors all at once, the circuit base material with which the activity is done will not move. Moreover, equipment cost can be reduced if a belt driving source is carried out in common.
(40) At least one side of each side frames of both of said Maine conveyor, said carrying-in conveyor, and said taking-out conveyor is used as the movable frame which can be approached and estranged to another side. and The Maine conveyor, a carrying-in conveyor And the embodiment term 30 containing the width-of-face modification equipment which is made to move each movable frame of a taking-out conveyor to coincidence, and changes the conveyance width of face of the Maine conveyor, a carrying-in conveyor, and a taking-out conveyor into coincidence 32 and 34 thru/or the circuit base material activity system of any one publication of 39.
(41) At least one side of each side frames of both of said Maine conveyor, said carrying-in conveyor, and said taking-out conveyor is used as the movable frame which can be approached and estranged to another side. And the width-of-face modification equipment which is made to move each movable frame of a carrying-in conveyor and a taking-out conveyor to coincidence, and changes the conveyance width of face of a carrying-in conveyor and a taking-out conveyor into coincidence, At the time of width-of-face modification by the width-of-face modification equipment, the movable frame of the Maine conveyor, The embodiment term 30 containing the frame coupling device which connects the movable frame of a carrying-in conveyor and a taking-out conveyor with the condition of moving in one 32 and 34 thru/or the circuit base material activity system of any one publication of 39. A frame coupling device has the connection member in which a location is possible in the connection location which connects the movable frame of the Maine conveyor, and the movable frame of a carrying-in conveyor and a taking-out conveyor, and the uncoupling location which is not connected. A connection member is good also as what is located by a connection location and the uncoupling location by actuation of an operator, or good also as what drives with a connection member driving gear and is automatically located by a connection location and the uncoupling location.
(42) The carrying-in side driving shaft with which said width-of-face modification equipment is formed corresponding to each of said carrying-in conveyor and said taking-out conveyor, and is prolonged ranging over said two or more shift positions of these conveyors, and a taking-out side driving shaft, Respectively pivotable on said carrying-in conveyor and said taking-out conveyor, and the driven body of revolution which is held at migration impossible at shaft orientations, and engages with said carrying-in side driving shaft and a taking-out side driving shaft possible [relative displacement to relative rotation impossible and shaft orientations], respectively, The movement inverter which changes rotation of the driven body of revolution into movement of said movable frame, A circuit base material activity system given in the embodiment terms 40 or 41 containing the rotation driving source for width-of-face modification, and the rotation transport unit which transmits

rotation of the rotation driving source for width-of-face modification to said carrying-in side driving shaft and a taking-out side driving shaft. According to this mode, it becomes easy to be able to share the rotation driving source for width-of-face modification on a carrying-in conveyor and a taking-out conveyor, and to make a width-of-face change of both conveyors to coincidence. And a shift with a carrying-in conveyor and a taking-out conveyor can be performed independently. Moreover, since each driven body of revolution of a carrying-in conveyor and a taking-out conveyor maintains the condition of having engaged with the carrying-in side driving shaft and the taking-out side driving shaft even if it shifts a carrying-in conveyor and a taking-out conveyor, even if carrying in and a taking-out conveyor are in any of two or more shift positions, conveyance width of face can be changed.

(43) The Maine conveyor side driving shaft with which said width-of-face modification equipment was further formed in the direction in which these Maine conveyor is located in a line with one of said two or more Maine conveyors, Pivotable on the Maine conveyor by which the Maine conveyor side driving shaft was established, and the driven body of revolution which is held at migration impossible at shaft orientations, and engages with said Maine conveyor side driving shaft possible [relative displacement to relative rotation impossible and shaft orientations], While the connection member which connects each movable frame of two or more of said Maine conveyors in one is included A circuit base material activity system given in the embodiment term 42 which is what said rotation transport unit adds rotation of said rotation driving source for width-of-face modification to said carrying-in side driving shaft and a taking-out side driving shaft, and transmits to said Maine conveyor side driving shaft.

(44) The embodiment term 27 which was equipped with the conveyor belt which at least one side of said Maine conveyor, and said carrying-in conveyor and taking-out conveyor conveys in support of a circuit base material, respectively, and at least one side of the Maine conveyor, and a carrying-in conveyor and a taking-out conveyor equipped with the respectively original belt driving source thru/or the passive-circuit-elements wearing system of any one publication of 43.

If the belt driving source of the Maine conveyor, a carrying-in conveyor, and a taking-out conveyor is made dedication, respectively, each conveyor can be operated independently and the degree of freedom of a passive-circuit-elements wearing system will improve.

[0016]

[Embodiment of the Invention] Hereafter, the passive-circuit-elements wearing system which is an operation gestalt common to the 1st thru/or the 9th invention is explained based on a drawing. This passive-circuit-elements wearing system 8 is upstream equipment formed in the upstream in the conveyance direction of a circuit base material, is a kind of a spreading system and constitutes electronic-circuitry assembly Rhine with the screen-stencil system which prints paste-like solder to passive circuit elements, and the downstream equipment slack reflow system (system which is made to carry out melting of the solder and connects passive circuit elements to a circuit base material electrically) formed in the downstream. Electronic-circuitry assembly Rhine is also a kind of a printed circuit board activity system.

[0017] The passive-circuit-elements wearing system 8 is explained. In drawing 1 , 10 is a pedestal. On the pedestal 10, the passive-circuit-elements feeders 14 and 16 and the passive-circuit-elements wearing equipments 18 and 20 of every 12 or 2 substrate conveyors are formed. The substrate conveyor 12 is equipped with two Maine conveyors 400,402, and every one carrying-in conveyor 404 and taking-out conveyor 406. These Maine conveyor 400,402 is arranged by juxtaposition in the right-angled direction (it considers as Y shaft orientations) in the conveyance direction (in drawing 1 , it is a longitudinal direction, and let the conveyance direction of a printed circuit board 408 be X shaft orientations) of the circuit base material slack printed circuit board 408 (refer to drawing 3), and the horizontal plane.

[0018] The carrying-in conveyor 404 is explained. As shown in drawing 2 , on the pedestal 10, the interior material susceptor 420 of a proposal is attached possible [height control] with the adjustment bolt 422 of height control member slack two or more books. The interior material susceptor 420 of a proposal constitutes the shape of a rectangular frame, as shown in drawing 4 , and it has the die length which adjoins over both Maine conveyors 400 and 402. While the interior material slack straight-line of proposal-like guide rail 424 is fixed, respectively on the frame part of a pair parallel to Y shaft orientations of the interior material susceptor 420 of a proposal, as shown in drawing 2 and drawing 4 , in four interior slack guide block 428 of a proposal-ed, fitting of the conveyor susceptor 426 is carried out movable, and the carrying-in conveyor 404 is formed on the conveyor susceptor 426.

[0019] The conveyor susceptor 426 constitutes the shape of a rectangular frame, and as shown in drawing 4 , it is being fixed to the migration child of the rod loess cylinder 436 in the center section of the longitudinal direction of the connection member 432 which connects the frame part 430 of a pair parallel to Y shaft orientations. The rod loess cylinder 436 is a pneumatic cylinder without a piston rod. In the rod loess cylinder 436, a piston and the migration child who was prepared in one and who does not illustrate maintain an airtight, it is made to project out of housing, and the connection member 432 is being fixed to the migration child. The rod loess cylinder 436 is formed in parallel with Y shaft orientations on said interior material susceptor 420 of a proposal, and when the conveyor susceptor 426 is moved by the rod loess cylinder 436, it is shifted to the 1st shift position which stands in a row on the Maine conveyor 400, and the 2nd shift position which stands in a row on the Maine conveyor 402 by the carrying-in conveyor 404. These conveyor susceptor 426 and the rod loess cylinder 436 constitute the carrying-in conveyor shifter 438. By detecting migration at the migration edge of a piston by migration edge detection equipment in the rod loess cylinder 436 shows whether the carrying-in conveyor 404 is located in the 1st shift position, or it is located in the 2nd shift position.

[0020] The carrying-in conveyor 404 has the side frame slack fixed frame 440 and the movable frame 442, as shown in drawing 4 . These frames 440,442 constitute a longitudinal configuration longer than the dimension of the substrate conveyance direction of the conveyor susceptor 426, and the movable frame 442 is movable in the substrate conveyance direction and a right-angled direction, and is attached in the conveyor susceptor 426 possible [approach and alienation] to the fixed frame 440 while while the fixed frame 440 is parallel to the substrate conveyance direction of the conveyor susceptor 426 is arranged in the substrate conveyance direction and parallel by being fixed to an edge by the substrate conveyance direction and parallel.

[0021] It is an edge parallel to the substrate conveyance direction of the conveyor susceptor 426, and with the side to which

the fixed frame 440 was fixed, the supporter 444 prolonged in the substrate conveyance direction and parallel is formed in the edge of the opposite side, and while the both ends of the guide rail 446 of the shape of a straight line of the interior material slack pair of a proposal are fixed, the both ends of the **** shaft 448 are supported by the fixed frame 440 and the supporter 444 pivotable. The guide rail 446 and the **** shaft 448 are arranged in the migration direction of the movable frame 442, and parallel, fitting of the interior material slack guide block 450 of a proposal-ed fixed to the movable frame 442 is carried out to a guide rail 446 movable, and the nut 452 fixed to the movable frame 442 is screwed in the **** shaft 448. These **** shaft 448 and the nut 452 constitute the ball thread which operates through the shot which is not illustrated. Therefore, if the **** shaft 448 is rotated, the movable frame 442 is guided with a guide rail 446, and you will approach the fixed frame 440 and it will be made to estrange.

[0022] As shown in drawing 4 , the castellated shaft 456 is attached in the surroundings of an axis parallel to Y shaft orientations pivotable at said interior material susceptor 420 of a proposal. As shown in drawing 2 and drawing 4 , a castellated shaft 456 is established ranging over the 1st and 2nd shift position, and is located in the fixed frame 440 and movable frame 442 bottom. Fitting is carried out to the fixed frame 440 with the bracket 457 (refer to drawing 3) at the castellated shaft 456 movable [the spline member 458 attached in migration impossible at shaft orientations / to relative rotation impossible and shaft orientations] pivotable. The spline member 458 is a member equipped with the spline hole which carries out spline fitting with a castellated shaft 456, and the sprocket 460 is formed in this spline member 458 in one. It is a chain 464 (refer to drawing 3 .) to a sprocket 460 and the sprocket 462 fixed to said screw-thread shaft 448. Illustration of a chain 464 is omitted in drawing 4 . It is wound, rotation of a castellated shaft 456 ****s, and it is transmitted to a shaft 448. 466 is a tension sprocket.

[0023] The sprocket 468 is being fixed to the edge made to project outside (for it to be the opposite side in the movable frame 442) from the fixed frame 440 of a castellated shaft 456 as shown in drawing 2 and drawing 4 . A castellated shaft 456 is rotated by moving the chain 470 (referring to drawing 2 and drawing 4) which was being wound around the sprocket 468, it ****s by that cause, a shaft 448 is rotated, the movable frame 442 is moved, and the conveyance width of face of the carrying-in conveyor 404 is changed. When the carrying-in conveyor 404 is shifted by migration of the conveyor susceptor 426, although the sprocket 460 of immobilization in the spline member 458 moves to shaft orientations to a castellated shaft 456 with the fixed frame 440, it is maintained at the condition that have carried out spline fitting and rotation is transmitted, even if the carrying-in conveyor 404 is located in which shift position, it ****s, and rotation is transmitted to a shaft 448, and conveyance width of face is changed. In addition, since a change of the conveyance width of face of the carrying-in conveyor 404 is made to modification and coincidence of the conveyance width of face of the Maine conveyor 400,402 and the taking-out conveyor 406, arrangement and the driving source of a chain 470 are explained later.

[0024] The supporter 444 of the fixed frame 440 and the conveyor susceptor 426 is supporting the both ends of the rotation transfer shaft slack castellated shaft 480 arranged in parallel with Y shaft orientations pivotable again, as shown in drawing 4 . Fitting of the edge by the side of the movable frame 442 of a castellated shaft 480 is carried out to the spline member 482 attached in migration impossible at shaft orientations movable [to relative rotation impossible and shaft orientations] pivotable on the movable frame 442. While a sprocket 484 is fixed to the edge projected outside from the fixed frame 440 of a castellated shaft 480, it connects with the sprocket 488 (refer to drawing 2) of immobilization in the output shaft of the motor 486 for belt driving source slack substrate conveyance with the chain 490. The motor 486 for substrate conveyance is an induction motor which is a kind of AC three phase motor.

[0025] The conveyor belt which is not illustrated is being wound around two or more pulleys 494 (two pieces are illustrated by drawing 4) attached in the pulley 492 (refer to drawing 2) and the fixed frame 440 which were prepared in the edge by the side of the fixed frame 440 of a castellated shaft 480 in one. The pulley which is not illustrated to the spline member 482, either is formed in one, and a conveyor belt is being wound around two or more pulleys 496 (two pieces are illustrated by drawing 4) attached in this pulley and movable frame 442 pivotable. Therefore, if the motor 486 for substrate conveyance is started, while a castellated shaft 480 is rotated, pulley 492 grade will be rotated, and the printed circuit board 408 which the conveyor belt of a pair was moved and was carried on the conveyor belt will be sent. The motor 486 for substrate conveyance is attached in the conveyor susceptor 426, it is moved with the carrying-in conveyor 404, and the carrying-in conveyor 404 functions as a driving source for printed circuit board conveyance also in the condition of being located in any of the 1st and 2nd shift position.

[0026] Migration of a printed circuit board 408 is guided by the perpendicular slideway of the interior material 498,500 (refer to drawing 4) of a proposal of the longitudinal configuration fixed to the fixed frame 440 and the movable frame 442, respectively from crosswise both sides. The presser-foot section which begins to be prolonged to up to a conveyor belt is prepared in the interior material 498,500 of a proposal, and surfacing from the conveyor belt of a printed circuit board 408 prevents **.

[0027] In the substrate conveyance direction of the fixed frame 440, as shown in drawing 4 , the substrate arrival check sensor 504 which detects arrival of a printed circuit board is attached in the part of the downstream. Although the substrate arrival check sensor 504 is a photoelectrical sensor of the reflective mold containing a light-emitting part and a light sensing portion, adoption of various sensors, such as a photoelectrical sensor of the transparency mold containing a light-emitting part and a light sensing portion, a limit switch, and a proximity switch, is possible for it.

[0028] The taking-out conveyor 406 is constituted like the carrying-in conveyor 404, gives the same sign to a corresponding part, and omits explanation. In addition, in the taking-out conveyor 406, the conveyor susceptor 426 and the rod loess cylinder 438 constitute the taking-out conveyor shifter 508, and the carrying-in conveyor 404 and the taking-out conveyor 406 are shifted for them by the carrying-in conveyor shifter 438 and the taking-out conveyor shifter 508 mutually-independent, respectively. In addition, as shown in drawing 1 , the operating member slack handle 510 for conveyance width-of-face modification is formed in the taking-out conveyor 406 side. While a revolving shaft 514 is attached pivotable with a bracket 512 on a pedestal 10 at the circumference of an axis parallel to Y shaft orientations, a handle 510 is fixed to the end section and the sprocket 516 is being fixed to the other end. Said chain 470 is being wound around a sprocket 516. A chain 470 is being wound also around the sprocket 518 attached in the bracket 512 pivotable again.

[0029] The Maine conveyor 400,402 is explained. The configuration of the Maine conveyor 400,402 is almost the same, and mainly explains the Maine conveyor 400. As shown in drawing 2 and drawing 4 , the conveyor susceptor 520 is being fixed to the part between the carrying-in conveyor 404 of a pedestal 10, and the taking-out conveyor 406. The conveyor susceptor 520 has the magnitude for two Maine conveyors in Y shaft orientations, and the interior material slack straight-line of proposal-like guide rail 522 (refer to drawing 4) is being fixed to both ends parallel to Y shaft orientations of the conveyor susceptor 520, respectively.
[0030] The Maine conveyor 400 has the side frame slack fixed frame 524 and the movable frame 526. These frames 524,526 accomplish the portal which has the leg 528 of a pair, and the connection section 530 which connects the upper limit section of these legs 528 as the fixed frame 524 is typically shown in drawing 2 , respectively, and the fixed frame 524 is being fixed to the conveyor susceptor 520 in the leg 528 of a pair. While the interior material slack guide block 532 of a proposal-ed is fixed to the leg 528 of the pair of the movable frame 526, respectively, fitting is carried out to the guide rail 522 movable.
[0031] As shown in the leg 528 of the pair of the fixed frame 524 of the Maine conveyor 400 at drawing 4 and drawing 5 , respectively, the end section of the **** shaft 536 is attached in pivotable and shaft orientations at migration impossible (only one screw-thread shaft 536 is illustrated by drawing 4). As shown in drawing 5 , respectively, while the screw-thread shaft 536 of these pairs is screwed in the nut 538 fixed to the both ends of a direction parallel to the substrate conveyance direction of the movable frame 526 of the Maine conveyor 400, respectively, the other end projected from the movable frame 526 is supported by the fixed frame 524 of the Maine conveyor 402 pivotable. These **** shaft 536 and the nut 538 constitute the ball thread. Moreover, each movable frame 526 of the Maine conveyors 400 and 402 is connected by the connection member 540, and is moved in one.
[0032] From the fixed frame 524 of the Maine conveyor 400 of the screw-thread shaft 536 of a top Norikazu pair, as shown in drawing 2 and drawing 5 , the sprocket 542 is being fixed to the protrusion edge, respectively. Said chain 470 is being wound around two or more sprockets 544 attached in the sprocket 542, and the conveyor susceptor 520 and the fixed frame 524, respectively as shown in drawing 2 and drawing 6 . Therefore, if rotation actuation of said handle 510 is done by the operator, while a chain 470 will be moved and two screw-thread shafts 536 of the Maine conveyor 400 will be rotated, each castellated shaft 456 of the carrying-in conveyor 404 and the taking-out conveyor 406 is rotated, it ****s, and a shaft 448 is rotated. thereby, each movable frame 442,526 of conveyors 400-406 is the same to the direction same all at once -- distance migration is carried out and each conveyance width of face of conveyors 400-406 is changed into the same magnitude as coincidence. Each movable frame 526 of the Maine conveyors 400 and 402 is connected by the connection member 540, when the movable frame 526 of the Maine conveyor 400 is moved by rotation of the **** shaft 536, the movable frame 526 of the Maine conveyor 402 is also moved, and conveyance width of face is changed.
[0033] The both ends which were far apart in the substrate conveyance direction are made into the start in the field where each connection section 530 of the fixed frame 524 and the movable frame 526 counters mutually, respectively, and while the pulley which is not illustrated to two or more places is attached pivotable, the endless conveyor belt 546 (refer to drawing 5) is being rolled. These conveyor belts 546 are moved by rotating the castellated shaft 548 supported by the fixed frame 524 and the movable frame 526 pivotable, respectively.
[0034] As shown in drawing 5 , while the castellated shaft 548 of the Maine conveyor 400 is supported by the fixed frame 524 pivotable, fitting of it is carried out to the movable frame 526 movable [the spline member 550 attached in migration impossible at shaft orientations / to relative rotation impossible and shaft orientations] pivotable. A pulley 553 is formed in the edge and the spline member 550 by the side of the fixed frame 524 of a castellated shaft 548 in one, respectively, and a conveyor belt 546 is being rolled. While it is made to project from the movable frame 526 of the Maine conveyor 400 further to a castellated shaft 548 and being supported by the fixed frame 524 of the Maine conveyor 402 pivotable, a pulley 553 is formed in one and a conveyor belt 546 is being rolled. This castellated shaft 548 and the castellated shaft 548 prepared in the Maine conveyor 402 are connected by the joint member 552, and is rotated in one.
[0035] While being made to project from the movable frame 526 as the castellated shaft 548 of the Maine conveyor 402 is shown in drawing 5 , the protrusion edge is supported by the supporter material 554 of immobilization in the conveyor susceptor 520 pivotable. While a sprocket 556 is fixed to this protrusion edge, it connects with the sprocket 560 (refer to drawing 4) of immobilization in the output shaft of the motor 558 for substrate conveyance attached in the supporter material 554 with the chain 562. The motor 558 for substrate conveyance is a speed-control motor which is a kind of AC three phase motor.
[0036] Therefore, if the motor 558 for substrate conveyance is started, two castellated shafts 548 will be rotated in one, a conveyor belt 546 will be moved by rotation of a pulley 553, and a printed circuit board 408 will be sent. In addition, migration of a conveyor belt 546 is guided with the belt guide 564 (refer to drawing 5) of immobilization on the fixed frame 524 and the movable frame 526. moreover, it shows migration of a printed circuit board 408 from crosswise both sides by the perpendicular slideway of the interior material 566,568 of a proposal of immobilization to the fixed frame 524 and the movable frame 526, respectively -- having -- from the conveyor belt 540 of a printed circuit board 408 -- coming floating -- it protruded on the interior material 566,568 of a proposal -- it presses down and is prevented by the section 570,572. A larger clearance than the thickness of a printed circuit board 408 is between the presser-foot section 570,572 and the top face of a conveyor belt 546, it presses down with the printed circuit board 408 laid on the conveyor belt 546, and a clearance is slightly prepared between the sections 570,572. Although the spline member 550 moves to shaft orientations to a castellated shaft 548 at the time of modification of conveyance width of face, it is maintained at the condition of having carried out spline fitting, and even if conveyance width of face is changed, rotation of the motor 558 for substrate conveyance is transmitted to a pulley 553, and a printed circuit board 408 is conveyed.
[0037] Further, as shown in drawing 5 , the pressure-from-below member 580 is attached in the field where the fixed frame 524 and the movable frame 526 counter mutually respectively possible [rise and fall]. Tabular [thin] is accomplished, and it has the almost same die length as the fixed frame 524 and the movable frame 526, it is fixed to the attachment component 582 attached in the fixed frame 524 and the movable frame 526 possible [rise and fall], respectively, and the pressure-from-below member 580 is located inside a conveyor belt 546 (conveyor-belt 546 side of another side).

[0038] The engagement member 584 (refer to drawing 2) protrudes on the both ends which were far apart in the longitudinal direction of the inferior surface of tongue of an attachment component 582 downward, respectively (only one engagement member 584 is illustrated by drawing 2). The attachment component 582 is energized below by the compression coil spring 586 (refer to drawing 2) as an elastic member which is a kind of the energization means arranged between said connection sections 530, and the pressure-from-below member 580 is evacuated from the conveyance side (field including the top face of the horizontal level of the conveyor-belt 546 top arranged annularly) of a printed circuit board 408 for the upper limit side to the evacuation location in which it is a lower part and does not interfere with a printed circuit board 408 by the usual state.
[0039] On said conveyor susceptor 520, as shown in drawing 5 , the ramp 598 and the ramp lifting device 600 are formed. A ramp 598 has a larger dimension among the printed circuit boards 408 which the Maine conveyor 400,402 conveys than the largest printed circuit board 408. In addition, distance between the legs 528 of said pair of said movable frame 526 is made larger than the dimension of X shaft orientations of a ramp 598, and he is trying not to interfere in it with a ramp 598 at the time of modification of conveyance width of face. Moreover, on the ramp 598, the substrate adsorption implement 602 of substrate supporter material slack plurality is formed possible [centering control] (one is illustrated by drawing 1 , drawing 4 , and drawing 5). The substrate adsorption implement 602 adsorbs a printed circuit board 408 with the negative pressure supplied with the vacuum devices which are not illustrated.
[0040] The ramp lifting device 600 has the rotation shaft 608 of a pair attached rotatable on the conveyor susceptor 520 at the circumference of an axis parallel to X shaft orientations, and the end section (refer to drawing 5) of a lever 610 is attached in the both ends of each rotation shaft 608 at relative rotation impossible, respectively. Fitting of the roller 612 attached in each one means edge of these four levers 610 pivotable is carried out to the engagement crevice 614 (refer to drawing 2) established in the inferior surface of tongue of a ramp 598 in one, respectively pivotable. If the rotation shaft 608 of a pair is rotated by the driving cylinder which one rotation shaft 608 does not illustrate, four levers 610 are rotated by coincidence, and it will maintain a posture with a level ramp 598, and will be made it to be connected so that it may rotate in one, and to go up and down. Rise and fall of a ramp 598 are guided by fitting of the guide rod 616 of immobilization in a ramp 598, and the guide cylinder 618 of immobilization on the conveyor susceptor 520 as shown in drawing 5 .
[0041] When a ramp 598 is raised, the substrate adsorption implement 602 adsorbs a printed circuit board 408 with negative pressure, and the back face of the supporter material covered with the suction cup made of the rubber of the substrate adsorption implement 602 supports a printed circuit board 408 from a lower part. Moreover, a ramp 598 engages with the engagement member 584, resists the energization force of the compression coil spring 586, raises an attachment component 582, as a result the pressure-from-below member 580, and makes a printed circuit board 408 thrust up from a conveyor belt 546. It is raised from a conveyor belt 546 and pinched by the presser-foot section 570,572 of the pressure-from-below member 580 and the interior material 566,568 of a proposal, and where the curvature to the upper part or a lower part is corrected, a printed circuit board 408 is fixed to the Maine conveyor 400,402, while it is adsorbed by the substrate adsorption spring 602 and supported from a lower part. The location on the ramp 598 of the substrate adsorption implement 602 is adjusted according to the dimension of a printed circuit board 408. When the dimension of a printed circuit board 408 is small, the substrate adsorption implement 602 may be omitted.
[0042] In the substrate conveyance direction of the Maine conveyor 400,402, as shown in drawing 4 , the moderation starting position sensor 620, the substrate arrival check sensor 622, and the substrate arrester 624 are formed in the downstream, respectively. The moderation starting position sensor 620 and the substrate arrival check sensor 622 are constituted by the photoelectrical sensor of the reflective mold which has a light-emitting part and a light sensing portion, respectively, and detect the attainment to the moderation starting position of a printed circuit board 408, and the attainment to a substrate arrival check location by reflection of the light from a printed circuit board 408. Notching 626 is formed in a ramp 598 and he is trying for light to be equivalent to a printed circuit board 408. The photoelectrical sensor of not only the photoelectrical sensor of a reflective mold but a transparency mold, a proximity switch, a limit switch, etc. may constitute the moderation starting position sensor 620 and the substrate arrival check sensor 622.
[0043] The substrate arrester 624 is formed in the downstream from both the sensors 620,622, and has the stopper member 630 and the lifting device 632 which makes it go up and down the stopper member 630. A lifting device 632 makes a driving source the hydrostatic pressure cylinder slack air cylinder 634, as shown in drawing 2 , and it is moved to the operation location which projects upwards and stops migration of a printed circuit board 408 from a conveyance side by the air cylinder 634, and the non-acting location which is evacuated down the conveyance side and permits passage of a printed circuit board 408 by the stopper member 630.
[0044] Thus, two Maine conveyors are formed in the substrate conveyor 12, and there are two conveyance paths of a printed circuit board 408 together with Y shaft orientations. The reflow system formed in the screen-stencil system and the downstream which were prepared in the upstream of this passive-circuit-elements wearing system 8 however, all The number of the conveyance paths of a printed circuit board 408 is one, and they are the equipment and the system which are located on the same line. The passive-circuit-elements wearing system 8 The conveyance path containing the Maine conveyor 400 is prepared in the location which is in agreement with the conveyance path of a screen-stencil system and a reflow system, and it is made to be carried out in the condition that carrying in and the taking-out conveyor 404,406 are located in the 1st shift position, in delivery of a printed circuit board 408. The side to which an operator works in the substrate conveyance direction of electronic-circuitry assembly Rhine constituted by this passive-circuit-elements wearing system 8 grade and a right-angled direction is defined beforehand, and is prepared in the location where the Maine conveyor 400 which becomes an operator side between two Maine conveyors 400,402 is located in a line with a screen-stencil system and a reflow system.
[0045] The passive-circuit-elements feeders 14 and 16 are explained. The passive-circuit-elements feeders 14 and 16 are arranged by the method of an outside of the Maine conveyor 400,402, respectively. The configuration of the passive-circuit-elements feeders 14 and 16 is the same, and the same is said of the class of passive circuit elements to supply. The passive-circuit-elements feeder 14 is explained typically.

[0046] The passive-circuit-elements feeder 14 is equipped with the passive-circuit-elements supply truck 52 (it is hereafter called a truck 52 for short) as the body section, and two or more feeders 54 which are held in a truck 52 and constitute the passive-circuit-elements feeder 14 with it as shown in drawing 7 . The feeder 54 is shown by the fictitious outline (two-dot chain line) in drawing 7 . The truck 52 is using as the main component the base 60, a handle 61, the frame 62 supported by the base 60, the frame plate 63 attached in the frame 62, the feeder supporting structure 64 prepared on the frame 62, and the two engagement sections 66 (one is illustrated by drawing 7) prepared in the frame 62.
[0047] The two engagement sections 66 make a pedestal 10 and a truck 52 coalesce mechanically by being made to engage with two engagement equipments 68 formed in said pedestal 10, as shown in drawing 8 . Each engagement equipment 68 is equipped with the engagement projection 70 of the petal mold in which the rotation which carries out a parallel displacement in the direction (it sets to drawing 8 and is a longitudinal direction) in which a pedestal 10 and a truck 52 are located in a line, and sets a revolving shaft as a shaft parallel to the migration direction is possible. The above-mentioned parallel displacement is performed by the double-acting air cylinder built in engagement equipment 68. Moreover, the cam mechanism which is not illustrated carries out fixed include-angle (for example, 90 degrees) rotation of the engagement projection 70 in process of this parallel displacement at the circumference of an axis parallel to that migration direction.
[0048] In the condition that the pedestal 10 and the truck 52 have not coalesced, a protrusion condition has the engagement projection 70, and it is in the rotation phase which can fit into the engagement section 66 and shaft orientations. The engagement section 66 is the notching 72 (they confront each other horizontally.) of the pair mutually prolonged in the reverse sense from the round hole section 71 and its round hole section 71. only one notching 72 is illustrated by drawing 7 -- **** -- it has opening which it has, and if a pedestal 10 and a truck 52 are made to approach for coalesce, the engagement projection 70 will pass the notching 72 of the engagement section 66. If air is supplied to one pressure room of an air cylinder and the outflow of the air from the pressure room of another side is permitted in the condition, it will ******** the engagement projection 70 being rotated by the forward direction, and the engagement projection 70 will engage with the engagement section 66 and shaft orientations at the beginning at balking impossible. Even after the engagement projection 70 suspends rotation, fixed distance ******** of it is carried out, and it is strongly drawn to a pedestal 10 by the truck 52 by it. If the supply condition of air is reversed, it is made to project, without the engagement projection 70 rotating, it is permitted that a truck 52 estranges from a pedestal 10, and it is rotated, the engagement projection 70 being made to project after that, and will be in the condition from which it can secede to shaft orientations from the engagement section 66 at the beginning.
[0049] Two guide taper sleeves 74 are formed in the pedestal 10 (one piece is illustrated by drawing 8). In the location which does not bar engagement in the engagement projection 70 and the engagement section 66, fitting of the guide taper sleeve 74 is carried out to the engagement section 66. Although fitting is carried out to the round hole section 71, since the engagement projection 70 is located in a truck 52 side in drawing 8 rather than the guide taper sleeve 74, specifically, engagement in the engagement projection 70 and the engagement section 66 is not barred. Positioning of a direction parallel to the vertical plane over the pedestal 10 of a truck 52 is correctly performed by fitting of 2 sets of guide taper sleeves 74, and the round hole section 71.
[0050] As shown in drawing 7 , the guide device 80 is formed in the pedestal 10 and the truck 52. The guide device 80 is constituted by two guide members 82 attached in a pedestal 10, and two rollers 84 attached in the base 60 of a truck 52 (the guide member 82 and every one roller 84 are illustrated by drawing 7 , and are in it, respectively). In addition, the location in the condition after the relative position of the guide member 82 and truck 52 which are shown in drawing 7 was made to coalesce to a pedestal 10 and a truck 52 is shown. In this condition, the fixed wheel 86 and the rotatable wheel 88 which are prepared two [at a time] in the base 60, respectively will be in the condition of having separated from the floor. Moreover, it will be in the condition of having estranged although rollers 84 were also few from the guide member 82. In both the condition that the pedestal 10 and the truck 52 have not coalesced, every two fixed wheels 86 and rotatable wheels 88 each are supported by the floor, and a truck 52 can be moved easily.
[0051] When a truck 52 is made to approach a pedestal 10 for coalesce, it has been rolled and the fixed wheel 86 is made to estrange from a floor the slant-face 90 top where the roller 84 is formed in the guide member 82 in the process. If a pedestal 10 and a truck 52 are made to approach further, a roller 84 will roll the guide-rail 92 top formed in the guide member 82. A guide rail 92 achieves the function in which engagement on a roller 84 adjusts the relative position of the horizontal direction (direction which intersects perpendicularly with the space of drawing 7) of a pedestal 10 and a truck 52 in the location which coalesce can accomplish easily. This enables it to start easily fitting of the round hole section 71 and the guide taper sleeve 74.
[0052] The detection equipment which is not illustrated is formed in the pedestal 10. The round hole section 71 and the guide taper sleeve 74 fit in, and the projection for coalesce detection (illustration abbreviation) prepared in the truck 52 is detected by the detection equipment which does not carry out [above-mentioned] illustration in the condition that you were made to contact the projection to which the contact section 94 is formed in a pedestal 10 and which is not illustrated. And if the projection for coalesce detection is detected by detection equipment, the air cylinder of engagement equipment 68 is operated, and it engages with shaft orientations in the engagement section 66 at balking impossible, and as mentioned above, the engagement projection 70 draws a truck 52 toward a pedestal 10, and is fixed.
[0053] As shown in drawing 8 , while a truck 52 is drawn to a pedestal 10 in the engagement section 66 and the contact side 96 of the engagement section 66 contacts the contact side 97 by the side of engagement equipment 68, positioning of the coalesce direction of a truck 52 is correctly performed by being made to contact the projection which is formed in a pedestal 10 in said contact section 94 and which is not illustrated. The flat surface (the example of illustration vertical plane) specified by the contact side of the projection which does not carry out [above-mentioned] illustration with the contact side 97 is a coalesce side, and a direction right-angled to the coalesce side is the coalesce direction. In addition, in the rotatable wheel 88, it is made still larger than the force required from a guide rail 92 in order to make it separate, respectively, and, as for the spasm force at the time of engagement equipment 68 drawing the engagement projection 70 to a pedestal 10 side, coalesce with a truck 52 and a pedestal 10 is made [roller / 84 / a floor to] firmly (for example, it considers as about [abbreviation

250kgf **2450N] magnitude every engagement equipment 68).
[0054] Every one feeder 54 is respectively held by two or more feeder maintenance units 100 prepared in the feeder supporting structure 64. In the truck 52 of this operation gestalt, a feeder attachment component is constituted by the body member (the below-mentioned base plate 106) of the feeder supporting structure 64, and the feeder attaching part is constituted by the feeder maintenance unit 100. This feeder supporting structure 64 is equipped with four feeder maintenance unit groups 102 which consist of six adjoining feeder maintenance units 100 (feeder maintenance 1 [100] of one feeder maintenance unit groups 102 is illustrated by drawing 7). Therefore, this feeder supporting structure 64 can hold a maximum of 24 feeders 54.
[0055] As shown in drawing 7 , the feeder maintenance unit 100 has a base plate 106, the engagement member 108 and guide plate 110 which were supported by the base plate 106, the air supply section 112 which supplies the compressed air to a feeder 54, and the power feed zone 114 which supplies various kinds of power to a feeder 54. A base plate 106 and a guide plate 110 are shared by all the feeder maintenance units 100, and the engagement member 108 is shared by six feeder maintenance units 100 which constitute each feeder maintenance unit group 102.
[0056] Two or more engagement slots (illustration abbreviation) which extend in parallel with the direction in which a pedestal 10 and a truck 52 are located in a line are established in the base plate 106 corresponding to each feeder maintenance unit 100. Each feeder 54 is equipped with the engagement projection 122 which can engage with the engagement slot and engagement member 108. In case each feeder 54 is held at the feeder maintenance unit 100, in drawing 7 , a parallel displacement is carried out from the right to the left, and it is held in the location finally shown in drawing 7 . Relative displacement of the direction where the space of drawing 7 and the feeder 54 held at the feeder maintenance unit 100 cross at right angles by engagement into the own engagement projection 122 and the engagement slot of a base plate 106 is forbidden. Moreover, migration of the vertical direction within a flat surface parallel to the space of drawing 7 is limited to few amounts by the guide plate 110 attached in the base plate 106 with two or more stanchions 124. Engagement and balking with the engagement projection 122 and the engagement member 108 in the case of attachment and detachment to the feeder maintenance unit 100 may be smoothly performed by this. And in the condition which shows in drawing 7 , it is forbidden that a feeder 54 moves perpendicularly to a base plate 106 by engagement to the engagement member 108 and the engagement projection 122.
[0057] The engagement member 126 of U typeface which goes feeder 54 self to a frame 62 and which is energized for it to be suitable (it sets to drawing 7 and is facing the left) is formed in the feeder 54 by engagement into the engagement slot 125 established in a base plate 106. This engagement member 126 is made to project, as shown in drawing 7 by the exterior of a feeder 54 if a lever 128 is not operated, but while the lever 128 is operated, it is contained inside a feeder 54. The device contained into a feeder 54 explains the engagement member 126 later using drawing 10 . In the process in which a feeder 54 is held at the feeder maintenance unit 100, although a lever 128 is operated so that the engagement member 126 may be stored in a feeder 54, if actuation of a lever 128 is canceled, a feeder 54 will be held firmly at the feeder maintenance unit 100. What is necessary is just to make the parallel displacement of the feeder 54 carry out rightward in drawing 7 , after operating a lever 128 and containing the engagement member 126 inside a feeder 54, in order to remove a feeder 54 from the feeder maintenance unit 100.
[0058] Moreover, the feed zone-ed [power] which is not illustrated for receiving supply of various kinds of power from a pedestal 10 side and the feed zone-ed [air] for receiving supply of the compressed air are prepared in the truck 52.
[0059] As shown in drawing 7 , a feeder 54 can equip with the components hold reel 150 which holds two or more passive circuit elements of the same class to two. The components hold tape 156 which consists of a tape-like hold container 152 which holds passive circuit elements, and a covering film 154 pasted up on the tape-like hold container 152 so that there may be that no the passive circuit elements in the tape-like hold container 152 drop [de] is twisted around the components hold reel 150. The components hold tape 156 is a tape of the embossing type which has the passive-circuit-elements hold section of the shape of a container of a large number by which the tape-like hold container 152 was made to project at equal intervals to a lower part from between the supporter-ed prolonged in a longitudinal direction in crosswise both sides, and the supporters-ed of these pairs. The covering film 154 adhered to the tape-like hold container 152 is a location (it is the location where the components adsorption nozzle 784 is shown in drawing 8 .) where passive circuit elements adsorb by the components adsorption nozzle 784. This location is a components supply location, it is a components fetch location, and the twist called a components fetch location is also hereafter removed from the tape-like hold container 152 slightly at the components hold reel 150 side (it sets to drawing 7 and is right-hand side). The tape-like hold container 152 which finished supply of passive circuit elements is sent to the passive-circuit-elements wearing equipment 18 side (it sets to drawing 7 and is left-hand side). The pitch of this delivery is made in agreement with the maintenance pitch of the passive circuit elements in the longitudinal direction of the tape-like hold container 152.
[0060] The tape-like hold container 152 which finished supply of passive circuit elements is led to the cutting means slack cutting machine 162 which cuts a tape by the tape guide 160. These tape guides 160 and a cutting machine 162 are attached in the frame 62. A cutting machine 162 cuts the tape-like hold container 152, and the piece of cutting of the cut tape-like hold container 152 is held in the piece hold machine 164 of cutting attached in the lower part of a frame 62. In addition, about processing of the covering film 154 removed from the tape-like hold container 152, it mentions later. The tape guide 160 and the cutting machine 162 are expressed by the fictitious outline (two-dot chain line) in drawing 7 .
[0061] Next, the configuration of a feeder 54 is explained. Drawing 9 is the side elevation of a feeder 54. A feeder 54 can equip with the components hold reel 150 which holds two or more passive circuit elements of the same class to two as mentioned above. A feeder 54 can supply independently one kind or two kinds of every one passive circuit elements held in one or two components hold reels 150 based on the supply instruction from a control unit 1050 (refer to drawing 24). It is also possible to supply the passive circuit elements of two components hold reels 150 to coincidence. However, although passive-circuit-elements wearing equipment 18 has two or more components adsorption nozzles 784 so that it may mention later, not every one components adsorption nozzle 784 of these plurality usually generates the demand which passive circuit elements are adsorbed, and plurality does not adsorb passive circuit elements at coincidence, and supplies passive circuit

elements to coincidence. Therefore, two or more feeders 54 do not receive a supply instruction to coincidence.
[0062] Drawing 10 is the front view expanding and showing some feeders 54. In addition, drawing 10 shows the condition that the 1st covering 192, the 2nd covering 194, and the 3rd covering 196 (refer to drawing 9) were removed. The feeder 54 is equipped with two driving gears 200,201 attached in the side plate 198 in order to supply the passive circuit elements held in the components hold tape 156 twisted around the components hold reel 150 to two.
[0063] The drive gear 204 by which one driving gear 200 is attached in the revolving shaft of a motor 202 and its motor 202, The driven gear 206 with more numbers of teeth than the drive gear 204 meshed with the drive gear 204, The driven gear 206, the driving pulley 208 formed in one, and the driving belt 210 which transmits the turning effort of the driving pulley 208, It has the driven pulley 212 driven with the driving belt 210, its driven pulley 212, and the sprocket 214 formed in one. Moreover, the driving belt 216 which transmits rotation of a driving pulley 208, the driven pulley 218 driven with the driving belt 216, its driven pulley 218, the pinch roller 220 of the driving side formed in one, and the pinch roller 222 by the side of the ranging behavior contacted by the contact pressure beforehand set as the peripheral face of a pinch roller 220 are included. That is, rotation of a motor 202 is transmitted to a sprocket 214, and a pinch roller 220 and a pinch roller 222.
[0064] The transit route is prescribed to the driving belt 210 by two or more guide idlers 224. Moreover, since a motor 202 is a pulse motor, its angle of rotation of a sprocket 214 is controllable by the number of the pulses given to a motor 202. In addition, angle of rotation of a motor 202 and a sprocket 214 differs by the same ratio as the product of the gear ratio of the drive gear 204 and the driven gear 206, and the ratio of the radius of a driving pulley 208 and the driven pulley 212. The engagement hole which stands in a row at fixed spacing is formed in the longitudinal direction, and it is made to engage with the projection formed at equal intervals on the periphery of a sprocket 214 by the tape-like hold container 152. In order to ensure the engagement, ** is prevented for surfacing from the sprocket 214 of the tape-like hold container 152 by covering 225.
[0065] Rotation of a sprocket 214 generates the tension resulting from the frictional resistance at the time of the components hold reel 150 being rotated, the rolling friction of a guide idler 224, etc. on the components hold tape 156. In this feeder 54, the components hold tape 156 can be easily sent with the feed per revolution of arbitration irrespective of the size of such a disturbance factor by changing the number of the pulses given to a motor 202. Therefore, even if the pitch in which passive circuit elements are held in the components hold tape 156 changes, it can be coped with easily. Pinch rollers 220 and 222 touch by the contact pressure set up beforehand, and as shown in drawing 9 , the covering film 154 removed from the components hold tape 156 is put among them.
[0066] Pinch rollers 220 and 222 achieve the function to remove the covering film 154 adhered to the components hold tape 156 one by one, by sending the part from which the covering film 154 is already removed to the components hold reel 150 side, in case the components hold tape 156 is sent by the sprocket 214. He is trying for the feed per revolution of this covering film 154 to become larger than the feed per revolution of the components hold tape 156 by the sprocket 214. And since the exfoliation location from the components hold tape 156 of the covering film 154 is prescribed by the cash-drawer slit of the covering film 154 formed in covering 225, fault Oita of the feed per revolution of the covering film 154 is absorbed by the skid over the covering film 154 of a pinch roller 220,222, and the covering film 154 between covering 225 and a pinch roller 220,222 is always maintained at turgescence.
[0067] The driving gear 201 of another side is similarly constituted by a motor 226, the drive gear 228, the driven gear 230, a driving pulley 232, driving belts 234 and 236, the driven pulley 238, pinch rollers 240 and 242, and guide-idler 244 grade. In addition, it is prepared in the location where the same thing as the above-mentioned sprocket 214 and the driven pulley 212 also overlaps this driving gear 201 in drawing 10 at them.
[0068] As shown in drawing 9 , the covering film 154 sent by a pinch roller 220,222 and the pinch roller 240,242, respectively passes through the inside of the pipe 246 attached where shaft orientations are made into the vertical direction in drawing 9 , and is dropped caudad. Therefore, in the condition that the feeder 54 is held at the feeder maintenance unit 100, the covering films 154 which should be discarded will be collected on the base 60 of a truck 52. Moreover, the air nozzle 248 is formed, and in case at least one side of a motor 202 and a motor 226 is rotated, he is trying to blow in caudad towards the inside of a pipe 246 at the compressed air from the upper part, in order to smooth passage of the covering film 154 in a pipe 246. Supply of the compressed air to an air nozzle 248 is made by opening a solenoid valve 250.
[0069] Some actuation switches which are not illustrated are formed in the feeder 54. the thing for determining the thing for making these actuation switches rotate a motor 202 and a motor 226 in forward reverse both directions independently, respectively and the rotational speed of each motor in the case of supply of passive circuit elements and one passive circuit elements are supplied -- ** -- the thing for determining whether operate the thing for determining angle of rotation of each motor and driving gears 200 and 201, respectively etc. is contained.
[0070] The lever 128 of a feeder 54 is energized by the sense rotated in the counterclockwise direction in drawing 10 with the energization member slack spring 252 focusing on the supporting point 254 as shown in drawing 10 . This energization force is transmitted to the engagement member 126 by the link mechanism 256, and the engagement member 126 is made to project in the condition that the lever 128 is not operated, in it by the exterior of a feeder 54. In order to make the interior of a feeder 54 contain the engagement member 126, a lever 128 is rotated in the clockwise direction in drawing 10 by making the supporting point 254 into the center of rotation.
[0071] The feeder 54 fitted in with the air supply section 112 of the feeder maintenance unit 100, and is equipped with the feed zone 272-ed [air] for supplying the compressed air to the above-mentioned solenoid valve 250. Furthermore, it also has the feed zone 274-ed [power] for connecting with the power feed zone 114 electrically, and supplying power to motor 202 grade. This power is supplied to a truck 52 from a pedestal 10 side. In addition, when the truck 52 and the pedestal 10 have not coalesced, the 2nd feed zone-ed [power] which is not illustrated for receiving supply of power is prepared in the truck 52. In the dead work performed in advance of wearing of passive circuit elements, the power supplied from this 2nd feed zone-ed [power] is used in the condition that the pedestal 10 and the truck 52 have not coalesced.
[0072] The passive-circuit-elements wearing equipments 18 and 20 are explained. As shown in drawing 1 , the passive-circuit-elements wearing equipments 18 and 20 all have the wearing head 650,652 and the XY robot 662,664 which it has

[robot] the X-axis slide 654,656 and the Y-axis slide 658,660, and moves the wearing head 650,652 to the location of the arbitration within a horizontal plane. The configuration of these wearing head 650,652 is the same, the XY robot's 662,664 configuration is the same, and the wearing head 650 and the XY robot 662 of passive-circuit-elements wearing equipment 18 are explained typically.

[0073] As shown in drawing 2 and drawing 3 , while the interior material slack straight-line of proposal-like guide rail 666 is formed in two places which were far apart in the substrate conveyance direction on said pedestal 10 (X shaft orientations) in parallel with Y shaft orientations, respectively, fitting of the Y-axis slide 658 is carried out movable. While it is longer than the dimension of X shaft orientations of the truck 52 in which said feeder 54 is attached and the guide block 668 (refer to drawing 2 and drawing 3) of every two interior material slack of a proposal-ed is fixed to the both ends of a longitudinal direction, respectively, fitting of the Y-axis slide 658 is carried out to the guide rail 666 movable.

[0074] It is screwed in the pedestal 10 by the **** shaft 672 attached in the circumference of an axis parallel to Y shaft orientations pivotable while a nut 670 is fixed to the part of the part top by which fitting was carried out to the guide rail 666 of a pair in parallel with Y shaft orientations, respectively, as shown in the Y-axis slide 658 at drawing 2 and drawing 3 . These nuts 670 and the **** shaft 672 constitute the ball thread. Two screw-thread shafts 672 are formed in each two places which were far apart in X shaft orientations of a pedestal 10 up and down, respectively, and the Y-axis slide 658 is screwed in the **** shaft 672 with which up-and-down locations differ in the end section and the other end of X shaft orientations. In addition, in order to avoid interference with the **** shaft 672 with which self is not screwed, the through tube (illustration abbreviation) is prepared in the Y-axis slide 658.

[0075] Four screw-thread shafts 672 are rotated by the driving source slack Y-axis servo motor 674 formed on the pedestal 10, respectively. The Y-axis servo motor 674 is an AC servo motor, two Y-axis servo motors 674 which drive the Y-axis slide 658 carry out a drive circuit in common, and it is synchronized and rotated. Therefore, although the Y-axis slide 658 has a longitudinal configuration, it can be moved at high speed, without prying based on the inertia of the Y-axis slide 658, the X-axis slide 654 carried in the Y-axis slide 658, and wearing head 650 grade, and producing ******. Although the guide rail 666 of a pair is common to the Y shaft each slide 658,660 of the passive-circuit-elements wearing equipments 18 and 20, the Y-axis slide 658,660 is driven according to an individual, and it does not interfere in it.

[0076] As shown in drawing 1 and drawing 3 , while the interior material slack straight-line of proposal-like two guide rails 676 are fixed to the inferior surface of tongue of the Y-axis slide 658 in parallel with X shaft orientations, fitting of the interior material slack guide block 680 of a proposal-ed fixed to the X-axis slide 654 is carried out movable. As shown in the top face of the X-axis slide 654 at drawing 3 , while a nut 684 is fixed with a bracket 682, it is arranged to the Y-axis slide 658 in parallel with X shaft orientations, and the X-axis slide 654 is moved to X shaft orientations pivotable and by [it was attached in shaft orientations at migration impossible] ****ing, being screwed in the shaft 686 and rotating the **** shaft 686 by the driving source slack X-axis servo motor 688 (referring to drawing 2). These nuts 684 and the **** shaft 686 constitute the ball thread. In addition, as for a sign 690,692 (refer to drawing 1 and drawing 2), flexible wiring, piping, etc. are personal protective equipment, personal protective equipment 690 protects the signal transduction line and feeder which were prepared between the pedestal 10 and the Y-axis slide 658, an air supply hose, a negative pressure supply hose, etc., and personal protective equipment 692 protects the signal transduction line formed between the Y-axis slide 658 and the X-axis slide 654. In addition, personal protective equipment 690 is illustrated by only drawing 1 , and personal protective equipment 692 is illustrated by only drawing 2 .

[0077] The wearing head 650 is carried in the X-axis slide 654. As the X-axis slide 654 is shown in drawing 11 , it has the supporter 700-ed which said guide block 680 was fixed, hung with the Y-axis slide 658, and was supported in the condition, and the connection section 702 made to hang from the end section of X shaft orientations of the supporter 700-ed to a lower part. As shown in drawing 11 and drawing 13 , while the attachment section 704 made to project horizontally is formed in the other end side of X shaft orientations of the supporter 700-ed, in the connection section 702, the center section of Y shaft orientations of the attachment section 704 is made to project horizontally to the opposite side, and let it be a supporter 706 at the lower limit section of the connection section 702.

[0078] As a supporter 706 is shown in drawing 11 , the lower limit section of a revolving shaft 708 is supported pivotable through bearing 710, and the upper limit section of a revolving shaft 708 is supported pivotable by the supporter 700-ed. The fixed cam 712 is being fixed to the supporter 700-ed. the fixed cam 712 -- the fitting hole 713 -- a revolving shaft 708 and this alignment -- and while penetrating the fixed cam 712 and being formed, fitting of the supporter 718-ed of a driver 716 is carried out pivotable through bearing 714. While being fixed to the upper limit section projected from the fixed cam 712 of the supporter 718-ed by this alignment and making it the driven pulley 722 rotate in one in it, these drivers 716 and the driven pulley 722 are supporting the revolving shaft 708 pivotable through bearing 720,721. A revolving shaft 708 is formed in the circumference of an axis (it is a vertical line) parallel to the perpendicular to a level conveyance flat surface pivotable, and the driver 716 and the driven pulley 722 are formed in the revolving shaft 708 and this alignment.

[0079] Rotation of the servo motor 724 for driving source slack bearing amendment modification reaches driving pulley 726, and it is winding, and is transmitted by the member slack timing belt 728, and arbitration is made for a driver 716 to carry out include-angle rotation, as shown in the above-mentioned driven pulley 722 at drawing 14 by forward reverse both directions. As shown in the driven pulley 722 at drawing 11 , the tabular detected body 730 is being fixed outward [radial], and when the driver Hara location sensor 732 (refer to drawing 14) fixed to the X-axis slide 654 detects this detected body 730, the original location of a driver 716 is detected. The original location of a driver 716 is detected by the power up, and the rotation location of a driver 716 calculates it based on it.

[0080] The driven body-of-revolution slack driven pulley 740 is being fixed to the upper limit section of a revolving shaft 708 by this alignment. it is shown in the driven pulley 740 at drawing 14 -- as -- a driving source -- rotation of the servo motor 742 for revolution -- a driving pulley 744 -- and -- winding -- applying -- a member -- it is transmitted by the timing belt 746 and arbitration is made to carry out include-angle rotation of the revolving shaft 708 with the servo motor 742 for revolution by forward reverse both directions As shown in drawing 11 , the tabular detected body 748 is being fixed outward [radial] by the driven pulley 740, and it understands the original location of a revolving shaft 708 by being detected by the

revolving-shaft Hara location sensor 750 (referring to drawing 14) by which this detected body 748 was fixed to the X-axis slide 654. The original location of a revolving shaft 708 is detected by the power up, and the rotation location of a revolving shaft 708 calculates based on it.

[0081] It is fixed to this alignment by the part bottom supported by the driver 716 of a revolving shaft 708, and the components adsorption shaft attachment component 760 constitutes the intermittent body of revolution 762 with the revolving shaft 708 to it. The components adsorption shaft attachment component 760 constitutes the shape of a cylinder generally, and the maintenance hole 764 penetrated in the direction parallel to axis of rotation is formed in 20 pieces and an equiangular distance on the whole place periphery centering on axis of rotation of the peripheral wall. Fitting of the shank slack shank material 768 which constitutes the components adsorption shaft 766 is carried out to each maintenance hole 764 movable [to shaft orientations] pivotable through bearing 770 and an attachment component 772, respectively, and 20 components adsorption shafts 766 are revolved in axis of rotation of the intermittent body of revolution 762 as a core at the time of rotation of the intermittent body of revolution 762.

[0082] The diameter of the maintenance hole 764 is larger than the diameter of the shank material 768, as shown in drawing 12 , an airtight is held by two seal members 774,776, fitting of the shank material 768 is carried out to the maintenance hole 764, and the circular ring-like path 780 is formed in the maintenance hole 764. While fitting of the above-mentioned attachment component 772 is carried out to bottom opening of the maintenance hole 764, it is fixed to the components adsorption shaft attachment component 760 with the fixed means slack bolt which is not illustrated, and one seal member 776 is held by the attachment component 772. The hole where bearing 770 and an attachment component 772 are attached in the components adsorption shaft attachment component 760 at relative-displacement impossible, and constitute a part of intermittent body of revolution 762, it is prepared in the part in which the bearing 770 of the maintenance hole 764 was attached, and an attachment component 772, and fitting of the shank material 768 is carried out constitutes the maintenance hole with the pivotable and shank material 768 by which fitting is carried out to shaft orientations movable.

[0083] While the lower limit section of the shank material 768 of the components adsorption shaft 766 is made to project from the components adsorption shaft attachment component 760 to a lower part and the nozzle fitting hole 782 is formed in this alignment, fitting of the relative displacement of the components adsorption nozzle 784 is made possible to shaft orientations. The components adsorption nozzle 784 has the adsorption tubing supporter 786 and the adsorption tubing 788 held by the adsorption tubing supporter 786, and is energized by the sense which projects from the nozzle fitting hole 782 by the compression coil spring 790 as an elastic member which is a kind of an energization means. The rotation to the extract and the shank material 768 from the nozzle fitting hole 782 of the components adsorption nozzle 784 is prevented when the engagement member slack pin 792 by which fitting was carried out to the adsorption tubing supporter 786 engages with the engagement crevice slack notching 794 formed in the peripheral wall of the nozzle fitting hole 782. 796 is the reflecting plate formed in the adsorption tubing supporter 786. Here, in order to give explanation easy, 20 components adsorption nozzles 784 are all the things of the same class, and the path of the adsorption tubing 788 makes them the same. Although the thing suitable for the class of passive circuit elements is chosen and the components adsorption nozzle 784 is attached in the shank material 768, the passive circuit elements to which the components adsorption nozzle 784 can stick can adsorb the passive circuit elements which are two or more kinds from which not only one kind but magnitude differs.

[0084] While the upper limit section of the shank material 768 is made to project upwards from the components adsorption shaft attachment component 760, the driven gear 800 and the cam follower supporter 802 are being fixed to the protrusion edge by this alignment. From said driver 716, a path is small and is clenched by the driver 716, by rotating a driver 716, all the driven gears 800 clenched by the driver 716 are rotated all at once, and driven gears 800 are rotated for 20 components adsorption shafts 766 by this direction whenever [isogonism] all at once.

[0085] The cam follower supporter 802 holds the cam follower 804 spherical inside to pivotable in all directions, and extract impossible, and is made to project from the cam follower supporter 802 upwards to a part of cam follower 804. The components adsorption shaft 766 is energized upwards by the compression coil spring 806 as an elastic member which is a kind of the energization means arranged in said path 780, and the cam follower 804 is made to contact the cam side 808 of said fixed cam 712 on it. The spring receptacle 810 of immobilization can receive the end section of the compression coil spring 806 in the shank material 768, and the other end is supported pivotable to the attachment component 772 by the bearing 812 attached in said attachment component 772 while it is held by the retainer. Therefore, when the components adsorption shaft 766 is rotated by the surroundings of an own axis, both the compression coil springs 806 rotate and torsion does not arise. The shank material 768 of the components adsorption shaft 766 is made to penetrate bearing 812, and is movable and pivotable to shaft orientations to bearing 812.

[0086] The fixed cam 712 has the cam side configuration section 814 of the shape of a revolving shaft 708 and a cylinder of this alignment, as shown in drawing 11 and drawing 12 , and the inferior surface of tongue of the cam side configuration section 814 is made into said cam side 808. The cam side 808 is established above the revolution locus of the components adsorption shaft 766, and as shown in drawing 11 and drawing 15 , a part of height is changed. Therefore, it is moved a cam follower 804 rolling along the cam side 808, and they are made to go up and down, when the intermittent body of revolution 762 is rotated, 20 components adsorption shafts 766 being revolved by the surroundings of the axis of a revolving shaft 708.

[0087] The intermittent body of revolution 762 is rotated, and when going up and down the components adsorption shaft 766 circling, said driven gear 800 fixed to the upper limit section of each shank material 768 of 20 components adsorption shafts 766 maintains the condition of having geared with the driver 716, respectively, and is made to go up and down. Even if a driver 716 is a direction parallel to axis of rotation of the intermittent body of revolution 762 where width of face is wide, its dimension of a direction parallel to the shaft orientations of the components adsorption shaft 766 is longer than a driven gear 800 and the components adsorption shaft 766 is made to go up and down, a driven gear 800 is maintained at the condition of having geared with the driver 716.

[0088] Moreover, notching 816 (refer to drawing 11 and drawing 13) is formed in the attachment section 704 of the X-axis slide 654 along the partial cylinder side centering on axis of rotation of the intermittent body of revolution 762, and interference with the passive circuit elements held at the components adsorption shaft 766 and it is avoided.

[0089] The cam side 808 is formed so that it may become high as it goes to the forward direction and hard flow from the lowest location, and it may become the highest in the location left 90 degrees also in which direction. 20 components adsorption shafts 766 are stopped for a revolving shaft 708 by the halt location of 20 pieces an include angle equal to the arrangement include-angle intermission of the components adsorption shaft 766, and by carrying out intermittent rotation. Among the halt locations of these 20 pieces, the location corresponding to the lowest part of the cam side 808 is made into a components adsorption stowed position (it can also be called a components receipt stowed position and a components adsorption release location), and it is the location distant from the components adsorption stowed position 90 degrees, and let the location corresponding to the highest part of the cam side 808 be an image pick-up location. The cam side 808 is formed so that the components adsorption shaft 766 may move horizontally after forward [of a components adsorption stowed position and an image pick-up location / each]. A setup of a components adsorber location and an image pick-up location is roughly shown in drawing 16 . A round head expresses the reflecting plate 796 of the components adsorption nozzle 784 among drawing.

[0090] Passive-circuit-elements image pick-up equipment 820 is formed in the location corresponding to the image pick-up location of the X-axis slide 654. Passive-circuit-elements image pick-up equipment 820 is attached in the end section of Y shaft orientations of said attachment section 704 of the X-axis slide 654 with brackets 824 and 826, as shown in drawing 13 and drawing 15 . A bracket 824 is ****ed in the attachment section 704, a member 828 and a slot 830 are fixed possible [the centering control of X shaft orientations], and the bracket 826 is being fixed to the bracket 824 by the **** member 832 and the slot 834 possible [the centering control of Y shaft orientations].

[0091] Passive-circuit-elements image pick-up equipment 820 is equipped with the lighting system 836, the reflector 838, and CCD camera 840. The lighting system 836 and the reflector 838 are formed in the passive-circuit-elements 842 bottom held at the components adsorption shaft 766 and the components adsorption shaft 766 which were stopped by the image pick-up location in the condition extend at a right angle to the tangent to the revolution locus of the components adsorption shaft 766 located in an image pick-up location, and axis of rotation of the intermittent body of revolution 762, and counter with passive circuit elements 842, as shown in drawing 15 . A reflector 838 has prism or two or more mirrors, changes the direction of image formation light, and it is made it to carry out ON light to CCD camera 840. A lighting system 836 has the lighting section 848 prepared in the both sides of a reflector 838, respectively, and irradiates light toward the reflecting plate 796 of the components adsorption nozzle 784. The horizontal location of passive-circuit-elements image pick-up equipment 820 can be adjusted by accommodation of the attaching position of a bracket 824,826. Moreover, a lighting system 836 can be removed by operating an operating member 850.

[0092] Thus, an image pick-up location is made higher than a components adsorption stowed position, and passive-circuit-elements image pick-up equipment 820 is arranged in the clearance formed when the components adsorption shaft 766 was raised by the fixed cam 712 and the cam follower 804. Avoiding interference with interference with passive circuit elements 814 and the passive-circuit-elements image pick-up equipment 820, the passive-circuit-elements feeder 14, and printed circuit board 408 which were held at passive-circuit-elements image pick-up equipment 820, the components adsorption nozzle 784, and it Rise-and-fall distance of the components adsorption nozzle 784 for components adsorption and wearing can be made small. If the height of the components adsorption shaft 766 in a components adsorption stowed position and an image pick-up location is the same That interference with passive-circuit-elements image pick-up equipment 820, the passive-circuit-elements feeder 14, and a printed circuit board 408 must be avoided, of course Interference with the passive circuit elements 814 held at passive-circuit-elements image pick-up equipment 820, the components adsorption shaft 766, and it must be avoided. If the components adsorption shaft 766 is raised by the fixed cam 712 and the cam follower 804 to the location of the components adsorption shaft 766 in a components adsorption stowed position becoming high, and the rise-and-fall distance for components adsorption and wearing becoming long By it, interference with passive-circuit-elements image pick-up equipment 820 can be avoided, the height of the components adsorption shaft 766 in a components adsorption stowed position can be made low, and rise-and-fall distance can be shortened.

[0093] As shown in drawing 11 , the reference mark image pick-up equipment 854 which picturizes the reference mark prepared in the printed circuit board 408 is carried in the X-axis slide 654 again. Reference mark image pick-up equipment 854 is attached downward in the lower part of the opposite side with the part in which passive-circuit-elements image pick-up equipment 820 was attached in Y shaft orientations of the connection section 702 of the X-axis slide 654.

[0094] Said components adsorption nozzle 784 adsorbs passive circuit elements 842 with negative pressure, and the pressure change-over valve 860 is being fixed to the external surface of the components adsorption shaft attachment component 760 by the equiangular distance about each of 20 components adsorption shafts 766 (two pieces are typically illustrated by drawing 15). In the components adsorption shaft 766, as shown in drawing 12 , it extends in shaft orientations, and the path 862 which is open for free passage in the nozzle fitting hole 782 is formed, and the path 862 is connected to the pressure change-over valve 860 by said path 780 formed between the maintenance hole 764 and the components adsorption shaft 766, and the path which was formed in the components adsorption shaft attachment component 760 and which is not illustrated.

[0095] Negative pressure is supplied to each of 12 pressure change-over valves 860 with the path 866 formed in the attachment section 704 of said X-axis slide 654, and a supporter 706, the path 868 in a circle, the path 870 formed in the revolving shaft 708, the hose which is not illustrated, as shown in drawing 11 . The path 866 is connected to vacuum devices through the hose which was attached in the X-axis slide 654 by the joint member and which is not illustrated. A path 870 is maintained at the condition that it was always open for free passage to the path 866 with the path 868 in a circle even if the revolving shaft 708 rotated.

[0096] the pressure change-over valve 860 is shown in drawing 12 -- as -- the inside of housing 872 -- the vertical direction -- a straight line -- being movable (rise and fall being possible) -- it has the arranged change-over member 874, and the pressure in the components adsorption nozzle 784 is switched to the pressure more than negative pressure and atmospheric pressure. It is moved to a negative pressure supply location by migration in a lower part, the pressure change-over valve 860 switches the pressure in the components adsorption nozzle 784 to negative pressure from the pressure more

than atmospheric pressure, and the change-over member 874 makes passive circuit elements 842 stick to the components adsorption nozzle 784. This change-over condition of the pressure change-over valve 860 is called a negative pressure supply condition. It is moved to a negative pressure discharge location by the migration to the upper part, the pressure change-over valve 860 switches the pressure in the components adsorption nozzle 784 to the pressure more than atmospheric pressure from negative pressure again, and the change-over member 874 makes the components adsorption nozzle 784 release passive circuit elements 842. This change-over condition of the pressure change-over valve 860 is called a negative pressure discharge condition. The stopper section 876,878 of a major diameter is formed in the both ends of the migration direction (shaft orientations) of the change-over member 874, respectively, and migration of the change-over member 874 is prevented in a negative pressure supply location and a negative pressure discharge location. The change-over member 874 consists of conditions of having been moved to the negative pressure supply location and the negative pressure discharge location again so that it may be maintained at each location.

[0097] As shown in drawing 17 thru/or drawing 19 , the device section of the individual lifting device 880 which makes it go up and down the components adsorption shaft 766, and the change-over valve control unit 882 is prepared in the near section of the components adsorption stowed position of the X-axis slide 654. As shown in drawing 17 and drawing 19 , the driving source slack linear motor 886 is being fixed to the part corresponding to the components adsorption stowed position of the X-axis slide 654. While being made for the needle 888 of a linear motor 886 to begun to be perpendicularly prolonged from housing of a linear motor 886 to a lower part, the migration member 890 is being fixed.

[0098] As shown in drawing 20 and drawing 22 , while the notching 891 which penetrates the migration member 890 in the direction parallel to the tangent to the revolution locus of the components adsorption shaft 766 stopped by the components adsorption stowed position is formed, the rise-and-fall driving member 892 is attached in the migration member 890 rotatable with the shaft 894 in the location from which it separated to the side at the circumference of a perpendicular axis from the revolution locus (an alternate long and short dash line shows to drawing 22) of the components adsorption shaft 766. As shown in drawing 18 , the sheet metal-like rise-and-fall mechanical component 896 is formed in the edge made to project from the shaft 894 of the rise-and-fall driving member 892 to the fixed cam 712 side, and fitting of the rise and fall is made possible to the notching 898 (refer to drawing 18 and drawing 21) prepared in the part corresponding to the components adsorption stowed position of said fixed cam 712. Even if notching 898 has the more slightly [than fitting and the width of face (dimension of the hoop direction of the fixed cam 712) to which fitting of the balking is made possible, and the thickness of the rise-and-fall mechanical component 896] large rise-and-fall mechanical component 896 and a cam follower 804 inserts it, it has the depth (dimension of a direction parallel to the center line of the fixed cam 712) which can be passed. [be / and / no clearance]

[0099] The rise-and-fall driving member 892 is made to go up and down by making the migration member 890 go up and down with a linear motor 886. The rise location where the migration member 890 is moved to rise end position, fitting of the rise and fall of the rise-and-fall mechanical component 896 is made possible to notching 898, and the inferior surface of tongue follows the cam side 808 of the fixed cam 712, The migration member 890 is dropped, the rise-and-fall mechanical component 896 separates from notching 898, and an inferior surface of tongue is made to go up and down between the downward locations in which it is caudad located from the cam side 808. In addition, although illustration is omitted, both the edges that were far apart in the components adsorption shaft revolution direction of the top face of the rise-and-fall mechanical component 896 are cut aslant, and are lacked, and the interior of a proposal to which it shows fitting to the notching 898 of the rise-and-fall mechanical component 896 is prepared.

[0100] With the side in which the rise-and-fall mechanical component 896 of the rise-and-fall driving member 892 was formed, as shown in drawing 20 , it extends in the longitudinal direction of the rise-and-fall driving member 892, and the positioning crevice slack notch 900 which intersects perpendicularly with the rotation axis of the rise-and-fall driving member 892 is formed in the inferior surface of tongue of the edge of the opposite side. The positioning implement 902 called Bors pulling is attached in said migration member 890. In the casing 906 screwed in the migration member 890, the positioning implement 902 is energized by that the positioning member slack ball 908 is movable and the sense which projects from casing 906 with the spring as an elastic member which is a kind of the energization means held in casing 906 while holding in extract impossible.

[0101] As shown in drawing 21 and drawing 22 , while a bracket 912 is fixed to the migration member 890 again, the stopper member slack adjustment bolt 914 in which centering control is possible is screwed. The adjustment bolt 914 is an edge side opposite to the side in which the rise-and-fall mechanical component 896 of the rise-and-fall driving member 892 was formed, and is prepared in drawing 22 from the rise-and-fall driving member 892 at the downstream to the revolution direction of the components adsorption shaft 766 shown by the arrow head. It is screwed in the sense right-angled [to the rotation axis of the rise-and-fall driving member 892] this adjustment bolt 914 and parallel to the tangent to the revolution locus of the components adsorption shaft 766 in a components adsorption stowed position, and the rotation limit to a direction contrary to the rotation direction at the time of being in a downward location by incorrect actuation of the rise-and-fall driving member 892, and being rotated with the components adsorption shaft 766 is specified.

[0102] After the rise-and-fall driving member 892 has contacted the adjustment bolt 914, while a ball 908 inserts the location at the tip of the adjustment bolt 914 in a notch 900 It engages with the side face on which the adjustment bolt 914 side of a notch 900 inclined. Separate from the side face of another side and the rise-and-fall driving member 896 is forced on the adjustment bolt 914 according to an operation of the slant face of the above-mentioned side face. It is adjusted so that the rise-and-fall mechanical component 896 may be positioned with a precision sufficient in the operation location (location shown in drawing 22 as a continuous line) which can fit into the notching 898 formed in the fixed cam 712. While a notch 900 and the positioning implement 902 constitute an energization means, the pointing device which is a kind of clip stop equipment is constituted with the adjustment bolt 914.

[0103] The migration detection equipment 920 (refer to drawing 24) which detects having rotated to the evacuation location as the rise-and-fall driving member 892 showed drawing 22 with a two-dot chain line is formed in the X-axis slide 654. When migration detection equipment 920 is constituted by the photoelectrical sensor of the transparency mold which has a light-

emitting part and a light sensing portion and light-receiving of a light sensing portion is barred by the rise-and-fall mechanical component 896 of the rise-and-fall driving member 892, it is detected that the rise-and-fall driving member 892 rotated to the evacuation location. The photoelectrical sensor of not only the photoelectrical sensor of a transparency mold but a reflective mold, a proximity switch, a limit switch, etc. may constitute migration detection equipment 920.
[0104] As shown in drawing 19 thru/or drawing 21 , the main air cylinder 930 is attached in said migration member 890 possible [the centering control of the vertical direction]. The main air cylinder 930 can determine the location of the vertical direction over the migration member 890 in contact with the adjustment bolt 932 screwed in the migration member 890, and is being fixed to the migration member 890 by screwing a bolt 940 in the migration member 890 through a cylinder tube 934 (referring to drawing 23) and the slot 938 of the attached section 936 (refer to drawing 21) prepared in one in the condition.

[0105] The main air cylinder 930 is constituted by the air cylinder which is a kind of a hydrostatic pressure cylinder. The main air cylinder 930 is a double acting cylinder, and fitting of the piston 944 is carried out to a cylinder tube 934 airtightly movable to shaft orientations, and it is made to project from a cylinder tube 934 to a lower part to a piston rod 946, as shown in drawing 23 . In these pistons 944 and a piston rod 946, the through hole 948 of the ** with a stage penetrated to shaft orientations is formed, and fitting of the fitting section 954 of the operation member 952 is carried out to shaft orientations movable at the major-diameter hole 950.
[0106] While the shank 956 which protruded on the fitting section 954 is made to project from a piston rod 946 to a lower part through the minor diameter hole 958, the large-sized operation section 960 is formed. The operation member 952 is energized by the sense which projects from a lower part 946, i.e., a piston rod, by the compression coil spring 962 as an elastic member which is a kind of the energization means arranged in the major-diameter hole 950. Whenever [to the lower part of the operation member 952 by energization of the compression coil spring 962 / motion limit] is prescribed by when the fitting section 954 engages with the base of the major-diameter hole 950. Moreover, the plug 964 screwed in opening of the major-diameter hole 950 has received the end section of the compression coil spring 962. The main air cylinder 930 is formed in the location in which it is located right above the change-over member 874 of the pressure change-over valve 860 prepared about the components adsorption shaft 766 stopped by the components adsorption stowed position, and the operation member 952 will be located right above the change-over member 874.
[0107] The bracket 970 is being fixed to the sense which begins to be prolonged below as shown in the near section of the components adsorption stowed position of the X-axis slide 654 at drawing 17 thru/or drawing 19 . While the interior material slack straight-line of proposal-like guide rail 972 is formed in the vertical direction, in the interior material slack guide block 978 of a proposal-ed, fitting of the cylinder tube 976 of the main air cylinder 974 which is a kind of a hydrostatic pressure cylinder is carried out to the perpendicular side face of a bracket 970 movable.
[0108] The main air cylinder 974 is a double acting cylinder, as shown in drawing 19 , into the cylinder tube 976, a piston 980 has an airtight held and fitting is carried out movable. While the piston rod 982 which protruded on the piston 980 is made to project from a cylinder tube 976 to a lower part, another hydrostatic pressure cylinder slack auxiliary air cylinder 984 is attached in the protrusion edge. The male screw section 986 is formed in the lower limit section of a piston rod 982, it is screwed in the cylinder tube 988 of the auxiliary air cylinder 984, and the location of the vertical direction over the main air cylinder 974 of the auxiliary air cylinder 984 can be adjusted by accommodation of the amount of screwing of the male screw section 986 in it.
[0109] The auxiliary air cylinder 982 is a double acting cylinder, and fitting of the cylinder tube 988 is carried out to said guide rail 972 movable in the interior material slack guide block 990 of a proposal-ed. Into the cylinder tube 988 of the auxiliary air cylinder 984, a piston 992 has an airtight held, fitting is carried out movable, and while a piston 992 and the piston rod 994 formed in one are made to project from a cylinder tube 988 to a lower part, the supporter material 998 is screwed in the male screw section 996 prepared in the protrusion edge. In the interior material slack guide block 1000 of a proposal-ed, fitting of the supporter material 998 is carried out to the guide rail 972 movable, and it can adjust the location of the vertical direction over the auxiliary air cylinder 984 of the supporter material 998 by accommodation of the amount of screwing of the male screw section 996.
[0110] In the interior material slack guide block 1004 of a proposal-ed, fitting of the operation member 1002 is carried out to the part below the part to which fitting of the supporter material 998 of a guide rail 972 was carried out movable. Between the operation member 1002 and the supporter material 998, the **** coil spring 1006 as an elastic member which is a kind of an energization means is formed, and the operation member 1002 is energized by the sense close to the supporter material 998. While the buffer member 1008 made from elastic material (for example, product made of rubber) is fixed, fitting of the relative displacement is made possible to shaft orientations in the fitting hole 1010 of the owner bottom formed in the operation member 1002, and whenever [based on the energization force of the **** coil spring 1006 / motion limit / of the operation member 1002] is prescribed to the inferior surface of tongue of the supporter material 998 by when the buffer member 1008 contacts the base of the fitting hole 1010. The operation member 1002 is moved by the energization force of the **** coil spring 1006, and the buffer member 1008 eases the impact at the time of stopping in the migration end position.

[0111] After the operation member 1002 is made to project horizontally to the intermittent body-of-revolution 762 side from the part by which fitting was carried out to the guide rail 972 as shown in drawing 17 , it is made it to begun to be prolonged under the change-over member 874 of the pressure change-over valve 860 prepared about the components adsorption shaft 766 stopped by the components adsorption stowed position. The operation member 1002 accomplishes about L typefaces. The contact member 1014 is screwed in the part located just under the change-over member 874 of the operation member 1002, and the operation section of the operation member 1002 is constituted into it. The slot 1016 penetrated in the diameter direction is formed in the upper part of the contact member 1014.
[0112] The operation member 1002 is connected to the air source of supply (illustration abbreviation) through the joint member 1018, the air supply hose which is not illustrated, as shown in drawing 18 and drawing 19 . The air (compressed air) supplied from the air source of supply is spouted upwards through the path 1022 formed in the path 1020 formed in the

operation member 1002, and the contact member 1016. the joint member 1018 and an air source of supply -- on the way -- being alike -- electromagnetism -- the closing motion valve 1024 (refer to drawing 24) is formed, and he permits supply of the air to the operation member 1002, and is trying to be intercepted Moreover, the variable-aperture valve 1026 is formed in the joint member 1018, and the flow rate of the air supplied to the operation member 1002 is extracted from an air source of supply.

[0113] As shown in said bracket 970 at drawing 18 and drawing 19 , it is attached in the circumference of an axis parallel to the tangent to the revolution locus of the pressure change-over valve 860 in which the link 1030 was established about the components adsorption shaft 766 stopped by the components adsorption stowed position with the shaft 1032 rotatable. The migration member 1034 is formed in the upper part of the cylinder tube 976 of said main air cylinder 974 in one, and fitting of the roller 1036 attached in this migration member 1034 pivotable is carried out to the notching 1038 (refer to drawing 18) formed in the end section of a link 1030 pivotable.

[0114] Moreover, fitting of the roller 1042 (refer to drawing 21) attached pivotable is carried out to the migration member 890 made to go up and down with said linear motor 886 pivotable at the notching 1040 (refer to drawing 18) formed in the other end of a link 1030. Therefore, if the migration member 890 is made to go up and down with a linear motor 886, a link 1030 is rotated, and the migration members 890 and 1034 will synchronize mechanically, it will be made to go up and down mutually by the symmetry, and the operation members 952 and 1002 will be made to approach and estrange to the change-over member 874 of the pressure change-over valve 860 mutually by the symmetry.

[0115] The control unit 1050 which controls this passive-circuit-elements wearing system 8 is constituted considering a computer 1052 as a subject, as shown in drawing 24 . A computer 1052 has CPU, ROM and RAM which are not illustrated, the bus which connects them, an input interface, an output interface, etc. The substrate arrival check sensor 504, the moderation starting position sensor 620, the substrate arrival check sensor 622, the driver Hara location sensor 732, the revolving-shaft Hara location sensor 750, passive-circuit-elements image pick-up equipment 820, reference mark image pick-up equipment 854, and migration detection equipment 920 grade are connected to the computer 1052. The drive circuit which is not illustrated is minded [1052] again. The air cylinder of engagement equipment 68 The solenoid valve 1058 for air cylinder control to control, motors 202 and 226, the solenoid valve 1060 for rod loess cylinder control which controls the rod loess cylinder 436, the motors 486 and 558 for substrate conveyance, the solenoid valve 1062 for air cylinder control which controls an air cylinder 634, The solenoid valve 1064 for the main air cylinder control which controls the Y-axis servo motor 674, the X-axis servo motor 688, the servo motor 724 for bearing amendment modification, the servo motor 742 for revolution, a linear motor 886, the main air cylinder 930,974, and the auxiliary air cylinder 984, respectively, 1066, the solenoid valve 1068 for auxiliary air cylinder control, and electromagnetism -- the closing motion valve 1024 grade is connected. Various programs required for supply of passive circuit elements 842, adsorption, wearing, carrying in of a printed circuit board 408, taking out, etc. are stored in ROM.

[0116] Next, actuation is explained. The passive-circuit-elements wearing equipments 18 and 20 equip with passive circuit elements 842 by turns the printed circuit board 408 in which positioning support was carried out by either of the Maine conveyor 400 and the Maine conveyor 402. It equips with all the passive circuit elements 842 by which wearing was planned in this passive-circuit-elements wearing system 8 about the printed circuit board 408 of one sheet jointly. While wearing of passive circuit elements 842 is performed about the printed circuit board 408 by which positioning support was carried out in one Maine conveyor, in the Maine conveyor of another side, taking out of a printed circuit board 408, carrying in, and positioning support are performed, and the carried-in printed circuit board 408 is made to stand by on the Maine conveyor in preparation for wearing of passive circuit elements 842. Wearing of the passive circuit elements 842 to the printed circuit board 408 made to stand by in the Maine conveyor of another side is started after wearing termination of the passive circuit elements 842 to the printed circuit board 408 in one Maine conveyor.

[0117] First, carrying in of a printed circuit board 408, positioning support, and taking out are explained. In addition, it is already started and suppose that it is wearing to a printed circuit board 408 in a stationary wearing condition. A printed circuit board 408 is carried in to the carrying-in conveyor 404 from the screen-stencil system formed in the upstream of this passive-circuit-elements wearing system 8. This carrying in is performed in the condition that the carrying-in conveyor 404 is located in the 1st shift position. If the carrying-in conveyor 404 is located by the 1st shift position, while the motor 486 for substrate conveyance will be started, a printed circuit board 408 is supplied to the carrying-in conveyor 404 from a screen-stencil system. By detecting migration at the migration edge of the piston of the rod loess cylinder 436 shows whether the carrying-in conveyor 404 is located in the 1st shift position, or it is located in the 2nd shift position. If the printed circuit board 408 carried in to the carrying-in conveyor 404 is detected by the substrate arrival check sensor 504, the motor 486 for substrate conveyance will be stopped and a printed circuit board 408 will be stopped on the carrying-in conveyor 404. And if the carrying-in conveyor 404 carries in a printed circuit board 408 to the Maine conveyor 400, the carrying-in conveyor 404 will be carried out [being located by the 1st shift position and].

[0118] In addition, after supply initiation of the printed circuit board 408 from a screen-stencil system, even if the setup time passes, when the substrate arrival check sensor 504 does not detect a printed circuit board 408, while a certain abnormalities occurred and wearing to the printed circuit board 408 of passive circuit elements 842 is interrupted, generating of abnormalities is reported. Interruption of wearing is not starting wearing of the passive circuit elements 842 to the following printed circuit board 408 after wearing to the printed circuit board 408 of the passive circuit elements 842 currently performed actually, and termination of taking out of a printed circuit board 408.

[0119] The printed circuit board 408 on the Maine conveyor 400 is taken out to the taking-out conveyor 406 (taking out is explained later), and if carrying in of the printed circuit board 408 to the Maine conveyor 400 is possible, the carrying-in conveyor 404 will carry in a printed circuit board 408 to the Maine conveyor 400. The substrate arrival check sensor 622 which is substrate detection equipment understands whether carrying in to the printed circuit board 408 to the Maine conveyor 400 is possible by whether the printed circuit board 408 is detected. At the time of carrying in of the printed circuit board 408 to the Maine conveyor 400, if the substrate arrival check sensor 622 does not detect a printed circuit board 408 when it is judged whether the printed circuit board 408 was carried in to the Maine conveyor 400 based on the detecting

signal of the substrate arrival check sensor 622 and it is except the time of carrying in, it turns out that there is no printed circuit board 408 on the Maine conveyor 400, and a printed circuit board 408 can be carried in to the Maine conveyor 400.
[0120] At the time of carrying in, the motor 486 for substrate conveyance of the carrying-in conveyor 404 and the motor 558 for substrate conveyance of the Maine conveyor 400,402 are started, conveyor-belt 546 grade is moved, and a printed circuit board 408 is carried in to the Maine conveyor 400 at it. At this time, the stopper member 630 of the substrate arrester 624 formed in the Maine conveyor 400 is moved to the operation location. A printed circuit board 408 is carried in, if detected by the moderation starting position sensor 620, a bearer rate will be slowed down, and if detected by the substrate arrival check sensor 622, the motor 558 for substrate conveyance will be stopped. at this time, a printed circuit board 408 stops migration in contact with the stopper member 630 -- having -- **** -- moderation of a bearer rate -- a printed circuit board 408 -- the stopper member 630 -- an impact -- it contacts few. In addition, after starting of the motor 558 for substrate conveyance, even if the setup time passes, when the substrate arrival check sensor 622 does not detect a printed circuit board 408, while a certain abnormalities occurred and wearing of the passive circuit elements 842 to a printed circuit board 408 is interrupted, generating of abnormalities is reported.
[0121] A ramp 598 is raised after a halt of the motor 558 for substrate conveyance, and while the substrate adsorption implement 602 adsorbs and supports a printed circuit board 408, the pressure-from-below member 580 raises and presses down a printed circuit board 408 from a conveyor belt 546, and pushes against the section 570,572. Thus, a printed circuit board 408 is made to stand by in preparation for wearing of passive circuit elements 842, where positioning support is carried out by Maine conveyor 400. Therefore, if wearing of the passive circuit elements 842 to the printed circuit board 408 by which positioning support was carried out by Maine conveyor 402 is completed, it will be moved to up to the printed circuit board 408 by which the passive-circuit-elements wearing equipment of another side is made to stand by in parallel to the evacuation (migration to a passive-circuit-elements feeder) of passive-circuit-elements wearing equipment which had finally equipped with passive circuit elements 842, and wearing of passive circuit elements 842 will be started. The time amount which the shift of a printed circuit board 408 takes is substantially set to 0, and wearing of the passive circuit elements 842 to a printed circuit board 408 is performed well. In addition, wearing of passive circuit elements 842 is later explained to a detail.
[0122] As mentioned above, although the motor 558 for substrate conveyance is common to two Maine conveyors 400,402 and each is moved for each conveyor belt 546 of the Maine conveyor 400,402 by the starting, since the printed circuit board 408 is raised from the conveyor belt 546 at the time of passive-circuit-elements wearing, it is not sent by migration of a conveyor belt 546, and wearing of the passive circuit elements 842 of a printed circuit board 408 and taking out which a printed circuit board 408 carries in and mentions later can be performed in parallel.
[0123] If wearing of passive circuit elements 842 is completed, the substrate adsorption implement 602 will be released by atmospheric air, and maintenance of a printed circuit board 408 will be canceled. Subsequently, after a ramp 598 is dropped and a printed circuit board 408 is laid on a conveyor belt 546, each motor 486,558 for substrate conveyance of the taking-out conveyor 406 and the Maine conveyor 400,402 is started, and a printed circuit board 408 is taken out to the taking-out conveyor 406. The taking-out conveyor 406 is shifted by the 1st shift position at the time of taking out of the printed circuit board 408 from the Maine conveyor 400. Moreover, the stopper member 630 is moved to the non-acting location.
[0124] If a printed circuit board 408 is taken out to the taking-out conveyor 406 and detected by the substrate arrival check sensor 504, the motor 486,558 for substrate conveyance will be stopped and a printed circuit board 408 will be made to stand by in preparation for delivery by the reflow system of the downstream on the taking-out conveyor 406. Immediately, if delivery is possible, the motor 486 for substrate conveyance of the taking-out conveyor 406 will not be stopped, but a printed circuit board 408 will be handed over by the reflow system as it is. Wearing is interrupted while generating of abnormalities is reported, if the substrate arrival check sensor 504 does not check a printed circuit board 408 even if the setup time passes since starting of the motor 486,558 for substrate conveyance also at the time of taking out.
[0125] The carrying-in conveyor 404 receives the following printed circuit board 408 from a screen-stencil system, after handing over a printed circuit board 408 on the Maine conveyor 400. And it is shifted to the 2nd shift position by migration of the conveyor susceptor 426, and is made to stand by in preparation for carrying in of the printed circuit board 408 to the Maine conveyor 402. After wearing of the passive circuit elements 842 to the printed circuit board 408 in the Maine conveyor 402 is completed and a printed circuit board 408 is taken out, a printed circuit board 408 is carried in to the Maine conveyor 402 from the carrying-in conveyor 404.
[0126] After the taking-out conveyor 406 passes the printed circuit board 408 taken out from the Maine conveyor 400 to the reflow system in which it was prepared by the downstream, it is shifted to the 2nd shift position by migration of the conveyor susceptor 426, and is made to stand by in preparation for taking out of a printed circuit board 408. After the taking-out conveyor 406 receives a printed circuit board 408, it is shifted to the 1st shift position and hands over a printed circuit board 408 to a reflow system.
[0127] In the Maine conveyor 400, positioning support is carried out similarly, and a printed circuit board 408 is made to stand by in preparation for wearing of passive circuit elements 842 in the Maine conveyor 402 after carrying in of the printed circuit board 408 from the carrying-in conveyor 404 to the Maine conveyor 402. Wearing of the passive circuit elements 824 to the printed circuit board 408 by which positioning support was carried out in the Maine conveyor 402 is started after wearing termination of the passive circuit elements 842 to the printed circuit board 408 by which positioning support was carried out in the Maine conveyor 400, and it is taken out after wearing termination to the taking-out conveyor 406.
[0128] the time of the class of printed circuit board 408 changing and changing the conveyance width of face of the Maine conveyors 400 and 402, the carrying-in conveyor 404, and the taking-out conveyor 406 -- any of each conveyors 400-406 -- although -- an operator does rotation actuation of the handle 510 in the condition of not supporting the printed circuit board 408, and a chain 470 is moved. thereby, the movable frame 442,526 of each conveyors 400-406 is the same to the direction same all at once -- distance migration is carried out and conveyance width of face is changed into the same magnitude as coincidence.
[0129] Wearing to the printed circuit board 408 of passive circuit elements 842 is explained. Wearing to the printed circuit

board 408 of passive circuit elements 842 is performed by turns by two passive-circuit-elements wearing equipments 18 and 20. The passive-circuit-elements feeder from which the passive-circuit-elements wearing equipments 18 and 20 take out passive circuit elements 842, respectively was decided, and passive-circuit-elements wearing equipment 18 takes out passive circuit elements 842 from the passive-circuit-elements feeder 14, and, as for passive-circuit-elements wearing equipment 20, takes out passive circuit elements 842 from the passive-circuit-elements feeder 16. Passive circuit elements 842 are taken out from the passive-circuit-elements feeder prepared in the respectively same side, and the Y shaft each slide 658,660 of two passive-circuit-elements wearing equipments 18 and 20 does not interfere at the time of drawing of the passive circuit elements 842 by the wearing head 650,652, and wearing.

[0130] In advance of wearing initiation of passive circuit elements 842, the reference mark of a printed circuit board 408 is picturized by reference mark image pick-up equipment 854. The image pick-up of a reference mark is performed, while a printed circuit board 408 is carried in to the Maine conveyor as mentioned above, and positioning support is carried out and standing by in preparation for wearing. An image pick-up is performed by the Maine conveyor which is supporting the waiting printed circuit board 408, and the reference mark image pick-up equipment 854 of the passive-circuit-elements wearing equipment formed in the same side in Y shaft orientations. If a printed circuit board 408 is carried in to the Maine conveyor of another side and positioning support is carried out while wearing of the passive circuit elements 842 to the printed circuit board 408 by which positioning support was carried out by one Maine conveyor is performed, after wearing ending to the printed circuit board 408 of all the passive circuit elements 842 that self holds, as the passive-circuit-elements wearing equipment formed in the same side as the Maine conveyor goes passive circuit elements 842 reception to a passive-circuit-elements feeder, it will picturize a reference mark. If the printed circuit board 408 equipped with passive circuit elements 842 next is carried in even if it is before wearing of all the planned passive circuit elements 842 is completed about the printed circuit board 408 of one sheet, the image pick-up of a reference mark will be performed. Two reference marks are prepared on the diagonal line at the printed circuit board 408, and among control, such as adsorption of passive circuit elements 842, and wearing, a computer 1052 calculates the position error of the X-axis and Y shaft orientations based on image pick-up data about each of two or more components wearing parts on a printed circuit board 408, and stores it in memory.

[0131] Wearing of the passive circuit elements 842 by the wearing head 650 is typically explained between two wearing heads 650,652. First, the wearing head 650 is moved to the passive-circuit-elements feeder 14, and takes out a number of passive circuit elements 842 set up beforehand from the passive-circuit-elements feeder 14. Here, all of the components adsorption shafts 766 whose number the number of wearing of 1 time of the passive circuit elements 842 of the wearing head 650 is 20 pieces, and is 20 shall adsorb passive circuit elements 842. Moreover, in order to give explanation easy, two or more feeders 54 are arranged in order of wearing of the passive circuit elements 842 to a printed circuit board 408, and by migration of the minimum distance of the intermittent body of revolution 762, the sequential-circuit components 842 shall be adsorbed and they shall equip with them while 20 components adsorption nozzles 784 are intermittently revolved by intermittent rotation of the intermittent body of revolution 762 of every one pitch.

[0132] Therefore, at the time of drawing of passive circuit elements 842, while 20 components adsorption shafts 766 are positioned one by one by intermittent rotation of the intermittent body of revolution 762 in a components adsorption stowed position, it is moved by the XY robot 662 to up to the components extraction location of the feeder 54 which supplies passive circuit elements 842. In addition, when the intermittent body of revolution 762 is made to carry out intermittent rotation, a driver 716 is rotated by this direction at an isogonism rate, and it is made for the components adsorption shaft 766 not to be rotated.

[0133] It is, before the components adsorption shaft 766 reaches to a components adsorption stowed position, if it will be in the condition that a cam follower 804 engages with the inferior surface of tongue of the rise-and-fall mechanical component 896 of the rise-and-fall driving member 892, while a linear motor 886 will be started and the migration member 890 will be dropped, the rise-and-fall driving member 892 is dropped, and the components adsorption shaft 766 is dropped. Revolution and descent of the components adsorption shaft 766 are performed in parallel. The components adsorption shaft 766 arrived at the components adsorption stowed position, before the components adsorption nozzle 784 contacted passive circuit elements 842, and it has stopped, and the components adsorption nozzle 784 can contact passive circuit elements 842 correctly. In addition, also when the components adsorption shaft 766 is dropped by the rise-and-fall driving member 892 in a components adsorption stowed position, a driven gear 800 is maintained at the condition of having geared with the driver 716.

[0134] The components hold tape 156 held by said feeder 54 is an embossing type components hold tape, and its location of the vertical direction (direction parallel to the migration direction of the components adsorption shaft 766) of the top face (adsorbed field) of the passive circuit elements 842 held in the components hold tape 156 is fixed regardless of the height of passive circuit elements 842. Moreover, 12 components adsorption nozzles 784 have a the same class, and its height of the inferior surface of tongue (adsorption side) of the adsorption tubing 788 of the components adsorption nozzle 784 positioned in the components adsorption stowed position is fixed. Therefore, the distance of the inferior surface of tongue of the adsorption tubing 788 of the components adsorption nozzle 784 positioned in the components adsorption stowed position and the top face of the passive circuit elements 842 which are supplied by the feeder 54 and located in a components fetch location is fixed regardless of the class of passive circuit elements 842, the rise-and-fall distance of the rise-and-fall driving member 892 is fixed, and it is slightly enlarged from the distance of the inferior surface of tongue of the adsorption tubing 788, and the top face of passive circuit elements 842. The rise-and-fall driving member 892 is made to carry out small distance descent further after the adsorption tubing 788 contacts passive circuit elements 842, he is trying to adsorb certainly at passive circuit elements 842, and an excessive downward distance is absorbed by compression of the compression coil spring 790 of the components adsorption nozzle 784. moreover, after it accelerates the components adsorption shaft 766 smoothly at the time of downward initiation when a linear motor 886 controls the speed, and being dropped, it is made to slow down smoothly -- having -- passive circuit elements 842 -- an impact -- it is made to contact few The rise-and-fall driving member 892 descends continuing slowing down, also when carrying out small distance descent, after the adsorption tubing 788 contacts passive circuit elements 842. If you make it go up and down the components

adsorption shaft 766 by making a linear motor 886 into a driving source, a lowering speed and rise-and-fall distance can be set up freely, and by shorter time amount, passive circuit elements 842 can be adsorbed and it can equip with them.
[0135] The relation between the XY robot's 662 actuation stage (namely, migration stage of the wearing head 650), the intermittent rotation stage of the intermittent body of revolution 762, and the rise-and-fall stage of the components adsorption shaft 766 is shown in the timing diagram of drawing 25 . These stages are expressed at the passing speed of the wearing head 650, the rotational speed of the intermittent body of revolution 762, and the rise-and-fall rate of the components adsorption shaft 766, respectively. The line of the slant which goes to top-most vertices among the lines which accomplish Yamagata in this drawing according to the passage of time expresses increase of a rate, and the line of the slant which separates from top-most vertices expresses reduction in a rate. Maintenance bearing amendment modification is modification in the bearing where the amendment of the maintenance bearing error of passive circuit elements 842 or bearing where the components adsorption shaft 766 adsorbed was beforehand set up so that it might mention later, and it is carried out by rotating a driver 716 and rotating the components adsorption shaft 766. Moreover, a components maintenance tape feed is delivery of the components hold tape 156 in a feeder 54, and an image pick-up is an image pick-up of the passive circuit elements 842 by passive-circuit-elements image pick-up equipment 820. The image pick-up stage is expressed with the existence instead of a rate.
[0136] While the main air cylinder 930 is dropped with descent of the migration member 890 and the operation member 952 is dropped, the migration member 1034 is raised by rotation of a link 1030, and the operation member 1002 is raised. As shown in drawing 26 , at the time of components adsorption and wearing, the drive command of the main air cylinder 930,974 and the auxiliary air cylinder 984 is outputted, and the solenoid valves 1064 and 1066 for the main air cylinder control and the solenoid valve 1068 for auxiliary air cylinder control are switched to it. ON command is outputted about the air cylinder which operates so that the operation members 952 and 1002 may be moved to an operation location side, and an OFF command is outputted about the air cylinder which operates so that the operation members 952 and 1002 may be moved to a non-acting location side. Thereby, it is located by the operation location which the piston rod 946 of the main air cylinder 930 was made to project from a cylinder tube 934, and the operation member 952 projected from the cylinder tube 934 as shown in drawing 19 at the time of adsorption of passive circuit elements 842. Moreover, it is made to project from a cylinder tube 976, the piston rod 994 of the auxiliary air cylinder 984 is ********(ed) into a cylinder tube 988, and the operation member 1002 is located in the piston rod 982 of the main air cylinder 974 by the non-acting location. In addition, it calls the main air cylinder 930,974 and the auxiliary air cylinder 984 projecting, and being in a condition or a lead-in condition about each piston rod 946,982,994 of the main air cylinder 930,974 and the auxiliary air cylinder 984 projecting, and it being in a condition or a lead-in condition hereafter.
[0137] The operation member 952 engages with the change-over member 874 of the pressure change-over valve 860, and it is made to move below with descent of the migration member 890, as shown in drawing 27 . Under the present circumstances, although the operation member 1002 goes up, it does not engage with the change-over member 874, but the change-over member 874 is moved to a negative pressure supply location, the pressure change-over valve 860 is switched to a negative pressure supply condition, and negative pressure is supplied to the components adsorption nozzle 784. At this time, the stopper section 876 has stopped the change-over member 874 in contact with housing 872. Although the migration members 890 and 1034 are mutually moved to the reverse sense with descent of the rise-and-fall driving member 892 and it acts from the opposite side mutually to the change-over member 874, since it synchronizes mechanically and is moved, the two operations members 952 and 1002 do not act on the change-over member 874 according to incorrect actuation and actuation delay etc. at coincidence, or an operation stage does not become unsuitable forward. It is the same also at the time of wearing to the printed circuit board 408 of passive circuit elements 874.
[0138] The negative pressure of height sufficient in a **** short time to adsorb passive circuit elements 842 is obtained, and the pressure change-over valve 860 can adsorb passive circuit elements 842 quickly, after it is switched to tip opening of the adsorption tubing 788 to the timing to which negative pressure is supplied just before the adsorption tubing 788 contacts passive circuit elements 842, and the adsorption tubing 788 contacts passive circuit elements 842. The change-over timing of the pressure change-over valve 860 can be adjusted by adjusting the location of the vertical direction over the migration member 890 of the main air cylinder 930 at the time of downward initiation. Thus, since descent of the components adsorption nozzle 784 and the change of the pressure change-over valve 860 are performed synchronously mechanically, the supply timing of negative pressure does not shift and generating of an adsorption mistake is avoided good. It is the same also at the time of wearing to the printed circuit board 408 of passive circuit elements 874, the discharge timing of negative pressure does not shift, and generating of a wearing mistake is avoided good.
[0139] At this time, the migration member 890 (rise-and-fall driving member 892) is made to carry out small distance descent further as mentioned above after the adsorption tubing 788 contacts passive circuit elements 842, but the change-over member 874 moved to the negative pressure supply location, the stopper section 876 has stopped in contact with housing 872, and an excessive downward distance is permitted, when the operation member 952 compresses the compression coil spring 962 and is displaced relatively to the migration member 890.
[0140] The migration member 890 is raised after adsorption of passive circuit elements 842, and the rise-and-fall driving member 892 is raised. Under the present circumstances, the components adsorption shaft 766 follows the rise-and-fall driving member 892 according to the energization force of the compression coil spring 806, is raised, and takes out passive circuit elements 842 from the tape-like hold container 152. Although the main air cylinder 930 will be raised, the operation member 952 will be raised and it will be made to estrange from the change-over member 874 if the migration member 890 is raised, the change-over member 874 is maintained at the condition of having been moved to the negative pressure supply location, and passive circuit elements 842 are maintained at the condition of having adsorbed by the components adsorption nozzle 784. Moreover, the operation member 1002 is dropped by descent of the migration member 1034.
[0141] Before the migration member 890 reaches to rise end position and the rise-and-fall mechanical component 896 fits into the notching 898 of the fixed cam 712, the intermittent body of revolution 762 is made to start rotation, and a cam follower 804 is moved along the inferior surface of tongue of the rise-and-fall mechanical component 896. Revolution and a

rise of the components adsorption shaft 766 are performed in parallel. By performing the rise and fall and revolution for components adsorption of the components adsorption shaft 766 and wearing in parallel, the time amount pitch in which two or more components adsorption shafts 766 carry out sequential attainment in a components adsorption stowed position can be shortened, and the wearing efficiency of passive circuit elements 842 can be raised. After the migration member 890 reaches to rise end position and the rise-and-fall mechanical component 896 fits into notching 898, a cam follower 804 changes to the cam side 808 of the fixed cam 712, and the components adsorption shaft 766 with which the components adsorption shaft 766 which adsorbed passive circuit elements 842 is evacuated from a components adsorption stowed position, and then adsorbs passive circuit elements 842 is quickly moved to a components adsorption stowed position.
[0142] Next, the components adsorption shaft 766 which adsorbs passive circuit elements 842 is moved to up to the components fetch location of the feeder 54 which supplies passive circuit elements 842, when the wearing head 650 is moved to X shaft orientations by the XY robot 662. In addition, if passive circuit elements 842 are taken out from the same feeder 54, the wearing head 650 will not be moved to X shaft orientations, but will be [that the intermittent body of revolution 762 is only rotated and]. In a feeder 54, the passive circuit elements 842 from which the components hold tape 156 is taken out by 1 pitch ****** and the degree are positioned after drawing of passive circuit elements 842 in a components extraction location.
[0143] If the rise-and-fall driving member 892 has already descended and it may be caudad located from a cam follower 804 by incorrect actuation of a linear motor 886 or a control unit 1050 etc. before a cam follower 804 engages with the inferior surface of tongue of the rise-and-fall mechanical component 896 when the intermittent body of revolution 762 is rotated and the components adsorption shaft 766 is moved to a components adsorption stowed position, the shank material 768 of a driven gear 800 or the components adsorption shaft 766 will contact the rise-and-fall mechanical component 896. However, if the force beyond the set point is applied to the rise-and-fall driving member 892 with revolution of the components adsorption shaft 766, the rise-and-fall driving member 892 will be rotated by drawing 22 to the evacuation location shown with a two-dot chain line, and damage on the rise-and-fall driving member 892 or components adsorption shaft 766 grade will be avoided. The rotation to the evacuation location of the rise-and-fall driving member 892 is detected by migration detection equipment 920, and is stopped by the adsorption activity based on the detection signal. Adsorption is started after the dissolution of the cause of abnormalities. While the rise-and-fall driving member 892 is returned to an operation location, fitting of the rise-and-fall mechanical component 896 is carried out to notching 898, the cam follower 804 of the components adsorption shaft 766 is made to engage with the inferior surface of tongue of the rise-and-fall mechanical component 896, and adsorption is resumed. It is the same also at the time of wearing to the printed circuit board 408 of passive circuit elements 842.
[0144] In addition, for example, incorrect actuation of the part which controls a linear motor 886 and the linear motor 886 of a control unit 1050 etc., Incorrect actuation of the part which controls the servo motor 742 for revolution and the servo motor 742 for revolution of a control device 1050 etc. arises in coincidence. Even if it originally may not stop although the components adsorption shaft 766 should stop in the components adsorption stowed position, and the rise-and-fall driving member 892 may be in a downward location at the time of passage of the components adsorption stowed position of the components adsorption shaft 766 The rise-and-fall driving member 892 is rotated to an evacuation location, the components adsorption shaft 766 circling, and a cam follower 804 overcomes notching 898 and damage is avoided.
[0145] After passive circuit elements 842 are taken out from a feeder 54 with the components adsorption shaft 766, before wearing to a printed circuit board 408, they are picturized by passive-circuit-elements image pick-up equipment 820. As it is indicated in drawing 16 as a components adsorption stowed position and an image pick-up location, it is separated 5 pitches (let the arrangement pitch of 20 components adsorption shafts 766 in the intermittent body of revolution 762 be one pitch), and the components adsorption shaft 766 which adsorbed passive circuit elements 842 is moved to an image pick-up location by intermittent rotation of the intermittent body of revolution 762 in parallel to other components adsorption shafts 766 being moved to a components adsorption stowed position. And passive circuit elements 842 are picturized by passive-circuit-elements image pick-up equipment 820, and each maintenance position error and maintenance bearing error of the X-axis and Y shaft orientations calculate. Although the image pick-up of the passive circuit elements 842 in an image pick-up location may be performed by the number of the passive circuit elements 842 to which it sticks etc. in parallel to adsorption of the passive circuit elements 842 in a components adsorption stowed position and it may be carried out in parallel to wearing, only an image pick-up may be performed. It is explained later. 20 components adsorption shafts 766 are carried in the intermittent body of revolution 762. By intermittent rotation of the intermittent body of revolution 762 Are concurrent with the components adsorption shaft 766 which adsorbed the components adsorption shaft 766 or passive circuit elements 842 which is not adsorbing passive circuit elements 842 being moved to a components adsorption stowed position. Since the components adsorption shaft 766 which adsorbed passive circuit elements 842 is moved to an image pick-up location, The wearing efficiency of passive circuit elements 842 can be raised securing time amount possible performing adsorption and an image pick-up of passive circuit elements 842 in parallel, and performing wearing and an image pick-up in parallel and required for calculation of the maintenance position error based on an image pick-up result, and a maintenance bearing error.

[0146] If all of 20 components adsorption shafts 766 adsorb passive circuit elements 842, the wearing head 650 will be moved by the XY robot 662 to up to a printed circuit board 408, and will equip with passive circuit elements 842. Wearing of passive circuit elements 842 is performed on the X-axis slide 654 in the same location as the time of components adsorption. The components adsorption shaft 766 which equips a printed circuit board 408 with passive circuit elements 842 is positioned by rotation of the intermittent body of revolution 762 in a components adsorption stowed position, and when the wearing head 650 is moved by the XY robot 662, it is moved to up to the components wearing part of a printed circuit board 408. Since adsorption and wearing of passive circuit elements 842 are performed in the same location, while the driving source (linear motor 886) for making it go up and down the components adsorption shaft 766 can be managed with one and can constitute equipment cheaply at the time of adsorption and wearing, the inertial load at the time of XY robot 662 actuation is small, it ends, and the wearing head 650 may be moved at high speed.

[0147] Passive circuit elements 842 are rotated to bearing set up with the include angle programmed beforehand while a maintenance bearing error is amended in parallel to the components adsorption shaft 766 being positioned by rotation of the intermittent body of revolution 762 in a components adsorption stowed position. Relative rotation of the driver 716 is carried out to the intermittent body of revolution 762, and the components adsorption shaft 766 is rotated around an own axis.
[0148] The driver 716 is meshed with each driven gear 800 of immobilization by all the components adsorption shafts 766, and components adsorption shafts 766 other than components adsorption shaft 766 which should amend a maintenance bearing error are also rotated. Therefore, in addition to an own maintenance bearing error and set-up own bearing, about the components adsorption shaft 766 which equips 2nd henceforth with passive circuit elements 842, angle of rotation and a direction are set up based on angle of rotation and the direction of the components adsorption shaft 766 which equipped with passive circuit elements 842 previously. Moreover, the XY robot's 662 migration length is amended that X shafts each of passive circuit elements 842 and the components wearing part of a printed circuit board 408 and the position error of Y shaft orientations should be canceled.
[0149] Like the time of components adsorption also at the time of components wearing, it is, before the components adsorption shaft 766 arrives at a components adsorption stowed position, after the cam follower 804 has engaged with the inferior surface of tongue of the rise-and-fall mechanical component 896 of the rise-and-fall driving member 892, the migration member 890 is dropped, and the components adsorption shaft 766 is dropped. When laying passive circuit elements 842 in a printed circuit board 408, the components adsorption shaft 766 has stopped very much to the components adsorption stowed position, and can equip a printed circuit board 408 with passive circuit elements 842 correctly.
[0150] Although the operation member 1002 will be raised while the operation member 952 is dropped if the migration member 890 is dropped, at the time of wearing of passive circuit elements 842, the main air cylinder 930 is made into a lead-in condition, and the operation member 952 is located in it by the non-acting location. To it, the operation member 1002 is higher than the time of adsorption of passive circuit elements 842, and it is located by the operation location near the change-over member 874, and the contact member 1014 engages with the change-over member 874 of the pressure change-over valve 860, makes it move upwards, makes it move to a negative pressure discharge location, and switches the pressure change-over valve 860 to a negative pressure discharge condition. At this time, the stopper section 878 stops the change-over member 874 in contact with housing 872.
[0151] Operation members 1002 are the operation location obtained by the main air cylinder 974 being made into a lead-in condition, and the auxiliary air cylinder 984 projecting and being considered as a condition so that it may mention later, and the operation location which are obtained by being made both the Lord and an auxiliary air cylinder 974,984 into a lead-in condition, and are alternatively located by the operation location high than the operation location obtained by being made only the main air cylinder 974 into a lead-in condition.
[0152] the electromagnetism which controls supply of the air to the pressure change-over valve 860, and cutoff -- the closing motion valve 1024 is opened before the contact member 1014 contacts the change-over member 874, if the pressure change-over valve 860 is switched to a negative pressure discharge condition, supply of air will be immediately started toward the components adsorption nozzle 784 from the pressure change-over valve 860, and passive circuit elements 842 will be released quickly. When the contact member 1014 contacts the change-over member 874, time amount is taken for the air which the inside of the path 780,862 grade which connects the pressure change-over valve 860 and the components adsorption nozzle 784 is in the negative pressure condition, and the pressure change-over valve 860 is switched to a negative pressure discharge condition, and is supplied to the pressure change-over valve 860 to reach tip opening of the adsorption tubing 788, but in order to release passive circuit elements 842 quickly, it is required to shorten this time amount. Although time of concentration can be shortened if there are many flow rates of the air supplied, there is a possibility of for making passive circuit elements 842 estranging from the adsorption tubing 788, and moving or blowing away passive circuit elements 842 on a printed circuit board 408. [too] Therefore, a slot 1016 is established in the contact member 1014, air is leaked, and he is trying for a flow rate to decrease. Although air leaks from a slot 1016 after the pressure change-over valve 860 was switched to the negative pressure discharge condition also until air reaches tip opening of the adsorption tubing 788 Since the inside of the path 780 grade which connects the pressure change-over valve 860 and the components adsorption nozzle 784 is in a negative pressure condition immediately after a change-over of the pressure change-over valve 860, Even if air leaks from a slot 1016, many of air supplied flows to the components adsorption nozzle 784, and air is quickly supplied to tip opening of the adsorption tubing 788. If air is supplied to tip opening of the adsorption tubing 788, and the pressure in the components adsorption nozzle 784 becomes close to atmospheric pressure or it increases to more than atmospheric pressure Since the pressure in the path 780 grade which connects the pressure change-over valve 860 and the components adsorption nozzle 784 increases, While the ullage of the air from a slot 1016 increases, the flow rate of the air which flows to the components adsorption nozzle 784 decreases, and the air of the suitable amount for making passive circuit elements 842 estrange from the adsorption tubing 788 is obtained.
[0153] The amount of drawing of the variable-aperture valve 1026 is set as the amount which passive circuit elements 842 are made to estrange from the adsorption tubing 788 by the leakage of the air from a slot 1016 by a suitable quantity of air, after air is quickly supplied to the components adsorption nozzle 784 in this way and the pressure in the components adsorption nozzle 784 rises. The total flow of the air supplied by accommodation of the amount of drawing of the air of the variable-aperture valve 1026 into the components adsorption nozzle 784 and the air which leaks into atmospheric air can be adjusted, and the ratio of the flow rate of the air to the components adsorption nozzle 784 immediately after a change-over in the negative pressure discharge condition of the pressure change-over valve 860 and after pressure increase can be adjusted as a result. In addition, when two or more kinds of components adsorption nozzles 784 are carried, it extracts according to the components adsorption nozzle 784 of middle magnitude, and an amount is set up.
[0154] Moreover, the pressure change-over valve 860 is not switched to a negative pressure discharge location at the beginning when the contact member 1014 contacted the change-over member 874, but since it is closed by the change-over member 874 and intercepted from the components adsorption nozzle 784, if a path 1022 is usual, the flow of air will stop it. however -- since air flows out through a slot 1016 since the slot 1016 is formed, and flow of air is made, at the same time

the change-over member 874 is switched to a negative pressure discharge location and supply of negative pressure is intercepted -- delay -- there is nothing -- moreover, pulsation -- air is supplied toward the components adsorption nozzle 784 few.

[0155] Thus, since passive circuit elements 842 are quickly released by supply of air, a change in the negative pressure discharge condition of the pressure change-over valve 860 is performed to the timing by which air is supplied to tip opening of the adsorption tubing 788, after passive circuit elements 842 contact a printed circuit board 408. It is because there is a possibility that the location of passive circuit elements 842 may shift if air is supplied to tip opening of the adsorption tubing 788 before passive circuit elements 842 are laid in a printed circuit board 408.

[0156] A printed circuit board 408 can be contacted in a short downward distance, and the change-over stage (release stage of the passive circuit elements 842 by supply of air) to the negative pressure discharge condition of the pressure change-over valve 860 can be early carried out, so that the height of passive circuit elements 842 is high. Although it is desirable to set up according to the height of passive circuit elements 842 as for the change-over stage of the pressure change-over valve 860, the operation location of the operation member 1002 is changed into two kinds, and the change-over stage of the pressure change-over valve 860 is changed into two kinds. Passive circuit elements 842 are classified into two kinds of size according to height. Therefore, about the large passive circuit elements 842 While downward distance of the migration member 890 is shortened, it is chosen as a side with the high operation location of the operation member 1002, and the change-over stage of the pressure change-over valve 860 is carried out early. About the small passive circuit elements 842 While downward distance of the migration member 890 is lengthened, it is chosen as a side with the low operation location of the operation member 1002, and the change-over stage of the pressure change-over valve 860 is made late.

[0157] It considers as the passive circuit elements 842 with height larger than 0 and the small passive circuit elements 842 3mm or less, and it is larger than 3mm and, specifically, considers as the passive circuit elements 842 with the large passive circuit elements 842 6mm or less. size -- also in classification [which], the downward distance of the migration member 890 is set up according to the passive circuit elements 842 with the smallest height among two or more kinds of passive circuit elements 842 belonging to each classification. As shown in drawing 28 and drawing 29 , 14mm, then in the case of the small passive circuit elements 842, downward distance is set to mm (14+alpha), and, in the case of the large passive circuit elements 842, the distance between the inferior surface of tongue of the adsorption tubing 788 of the components adsorption shaft 766 positioned in the components adsorption stowed position and a printed circuit board 408 is made into mm (11+alpha). He is trying for the passive circuit elements 842 with the smallest height to be certainly contacted by the printed circuit board 408. In addition, the difference of the distance of the vertical direction of two operation locations of the operation member 1002 is set to 3mm.

[0158] The change-over timing of the pressure change-over valve 860 can be adjusted adjusting the location of the vertical direction over the migration member 1034 of the operation member 1002, i.e., by adjusting the location of the vertical direction over the main air cylinder 974 of the auxiliary air cylinder 984, and the location of the vertical direction over the auxiliary air cylinder 984 of the supporter material 998, respectively. Also in any at the time of wearing of the large passive circuit elements 842, and wearing of the small passive circuit elements 842, after the passive circuit elements 842 with the smallest height among the passive circuit elements 842 contained in each classification are laid on a printed circuit board 408, the change-over timing of the pressure change-over valve 860 is adjusted so that the change of the pressure change-over valve 860 may be performed to the timing by which air is supplied to tip opening of the adsorption tubing 788. Although the supply stage of air is overdue about the passive circuit elements 842 with large height among the passive circuit elements 842 which belong to each large and small classification, respectively, being released by supply of air, after laying to a printed circuit board 408 is guaranteed also about which passive circuit elements 842. The pressure change-over valve 860 is switched to the timing set up as mentioned above, and the downward distance of the migration member 890 is set as the magnitude it is guaranteed to be that it will be in the condition that the stopper section 878 of the change-over member 874 moved to the negative pressure discharge location in contact with housing 872 while passive circuit elements 842 are certainly laid in a printed circuit board 408.

[0159] Height is larger than 0 and the main air cylinder 930,974 and the auxiliary cylinder 984 drive according to the drive command shown in drawing 26 at the time of wearing to the printed circuit board 408 of the passive circuit elements 842 3mm or less, as shown in drawing 28 (a), while the main air cylinder 974 is made into a lead-in condition, the auxiliary air cylinder 984 projects and it considers as a condition, and the operation member 1002 is in a lower operation location, and it is made the change-over stage of the pressure change-over valve 860 become late. Moreover, the main air cylinder 930 is made into a lead-in condition, and the operation member 952 is located by the non-acting location and it is made not to be contacted by the change-over member 874. In addition, a part of member which constitutes the change-over valve control unit 882 is illustrated by drawing 28 (a), (b), and drawing 29 (a) mentioned later and (b) on account of illustration.

[0160] Passive circuit elements 842 contact a printed circuit board 408, and the migration member 890 is made to carry out small distance descent further after that, as shown in drawing 28 (b) by descent of the migration member 890. This descent is permitted by compression of the compression coil spring 790 of the components adsorption nozzle 784.

[0161] Moreover, the contact member 1014 moves the change-over member 874 upwards, and the pressure change-over valve 860 is switched to a negative pressure discharge condition. Descent (rise of the migration member 1034) of the migration member 890 after this change is permitted by moving upwards to the operation member 1002, the supporter material 998 extending the **** coil spring 1006, and damage on the contact member 1014 and the pressure change-over valve 860 is avoided. the electromagnetism after the setup time, i.e., sufficient time amount to release passive circuit elements 842, and air were supplied from the air supply to tip opening of the adsorption tubing 788 -- the closing motion valve 1024 is closed and supply of air is intercepted.

[0162] it controls so that the lowering speed of the migration member 890 accelerates and slows down a linear motor 886 also at the time of wearing of passive circuit elements 842 -- having -- passive circuit elements 842 -- an impact -- it is contacted to a printed circuit board 408 few. downward distance -- size -- although it is common about two or more kinds of passive circuit elements 842 belonging to the same classification, since the contact stage to the printed circuit board 408

of passive circuit elements 842 is so early that the height of passive circuit elements 842 is large -- size -- even if it is the passive circuit elements 842 belonging to the same classification, a moderation initiation stage is early carried out, so that the height of passive circuit elements 842 is large.
[0163] Both the main air cylinder 974 and the auxiliary air cylinder 984 are made into a lead-in condition, and it is made for the change-over stage of the pressure change-over valve 860 to become early at the time of wearing to the printed circuit board 408 of the passive circuit elements 842 with large height, as shown in drawing 29 (a). And as shown in drawing 29 (b), the operation member 1002 goes up, and the contact member 1014 contacts the change-over member 874, and makes it move to a negative pressure discharge location by descent of the migration member 890. After laying to the printed circuit board 38 of passive circuit elements 842, air is supplied to tip opening of the adsorption tubing 788, and passive circuit elements 842 are released.
[0164] After wearing of passive circuit elements 842, while the migration member 890 is raised, the intermittent body of revolution 762 is rotated and the components adsorption shaft 766 which equips a printed circuit board 408 with passive circuit elements 842 next is positioned in a components adsorption stowed position. Moreover, the wearing head 650 is moved by the XY robot 662, and a components adsorption stowed position is moved to up to another components wearing part. Also in parallel to the time of wearing of passive circuit elements 842, rise of the components adsorption shaft 766 and intermittent rotation of the intermittent body of revolution 762 are performed, and the components adsorption shaft 766 which equips with passive circuit elements 842 next is positioned quickly in a components adsorption stowed position.
[0165] Thus, at the time of adsorption of passive circuit elements 842, before the adsorption tubing 788 contacts passive circuit elements 842, negative pressure is supplied to tip opening of the adsorption tubing 788, and passive circuit elements 842 can be adsorbed quickly. While the downward distance of the migration member 890 and the change-over stage to the negative pressure discharge condition of the pressure change-over valve 860 are changed into two kinds according to the height of passive circuit elements 842 and useless descent of the migration member 890 is lessened at the time of wearing of passive circuit elements 842 By releasing passive circuit elements 842 quickly by supply of air, after laying to a printed circuit board 408, the time amount which the time amount and components wearing which components adsorption takes take becomes short, and the high passive-circuit-elements wearing equipments 18 and 20 of wearing efficiency are obtained.
[0166] As shown in the timing diagram of drawing 25 , the rise and fall for amendment and modification of the horizontal migration of the wearing head 650 by the XY robot's 662 actuation, intermittent rotation of the intermittent body of revolution 762, and the maintenance bearing error of passive circuit elements 842, and components wearing of the components adsorption shaft 766 are performed repeatedly. If a printed circuit board 408 is equipped with all the passive circuit elements 842 held in the wearing head 650, the wearing head 650 will move to the passive-circuit-elements feeder 14 for drawing of the passive circuit elements 842 with which a degree is equipped. During wearing of the passive circuit elements 842 by passive-circuit-elements wearing equipment 18, passive-circuit-elements wearing equipment 20 is performing drawing of passive circuit elements 842 from the passive-circuit-elements feeder 16, after wearing termination of the passive circuit elements 842 by passive-circuit-elements wearing equipment 18, is changed immediately and starts wearing of the passive circuit elements 842 to a printed circuit board 408. To a printed circuit board 408, it is absent from almost, and is equipped with passive circuit elements 842 that there is nothing, and wearing is performed well.
[0167] In addition, when it differs from the class according to which the passive circuit elements 842 which the adsorption error generated, and which were case for example, adsorbed were planned, or when the maintenance bearing error of passive circuit elements 842 is excessive, a printed circuit board 408 is not equipped with passive circuit elements 842. Even if the components adsorption shaft 766 is positioned in a components adsorption stowed position, a linear motor 886 is not started, and the components adsorption shaft 766 is not dropped. And after wearing termination of all the passive circuit elements 842 (the passive circuit elements 842 with an adsorption error remove) that a wearing head holds, while moving to a passive-circuit-elements feeder, a wearing head is moved to up to the passive-circuit-elements hold machine which is not illustrated, and the passive circuit elements 842 with an error are thrown away. The components adsorption shaft 766 which adsorbed the passive circuit elements 842 thrown away at this time is positioned in the components adsorption stowed position, and after that components adsorption shaft 766 results on a passive-circuit-elements hold machine, or just before resulting on a passive-circuit-elements hold machine, a linear motor 886 is started. The operation member 952 is located in a non-acting location, the operation member 1002 is located by the operation location, the operation member 1002 engages with the change-over member 874 by descent of the migration member 890, it is made to move to a negative pressure discharge location, the pressure change-over valve 860 is switched to a negative pressure discharge condition, and passive circuit elements 842 are thrown away. If the operation member 1002 is located by the upper operation location, passive circuit elements 842 will be released by short time amount after starting of a linear motor 886 rather than the case where it is located by the lower operation location. It is also possible to throw away passive circuit elements 842, moving, without stopping a wearing head, if a passive-circuit-elements hold machine is a hold machine of a longitudinal configuration although passive circuit elements 842 are thrown away where a wearing head is stopped on a passive-circuit-elements hold machine.
[0168] As mentioned above, when the components adsorption shaft 766 which adsorbed passive circuit elements 842 is moved toward an image pick-up location after adsorption in parallel to the following components adsorption shaft 766 being moved to a components adsorption stowed position by rotation of the intermittent body of revolution 762 and an image pick-up location is reached, passive circuit elements 842 are picturized by passive-circuit-elements image pick-up equipment 820. However, when the number of the passive circuit elements 842 with which it 5-pitch-detached-building-****** and equips is five or less, even if a components adsorption stowed position and an image pick-up location are 20 pieces, of course, when adsorption of the passive circuit elements 842 of a constant is completed beforehand, the passive circuit elements 842 with which an image pick-up cannot be managed arise.
[0169] Therefore, 1 time of the number of components adsorption of ** passive-circuit-elements wearing equipments 18 and 20 is 20 pieces. It is the case where all of 20 components adsorption shafts 766 are used for adsorption of passive circuit elements 842. The bearing modification include angle of the passive circuit elements 842 by which the 1st thru/or the 5th are adsorbed is 0**15 degrees (+15 or less degrees -15 degrees or more). In the case of within the limits of 90**15 degrees

same as others, 180**15 degrees, and 270**15 degrees ** 1 time of the number of components adsorption of the passive-circuit-elements wearing equipments 18 and 20 is 20 pieces. It is the case where all of 20 components adsorption shafts 766 are used for adsorption of passive circuit elements 842. When the bearing modification include angle of the passive circuit elements 842 by which the 1st thru/or the 5th are adsorbed is an include angle of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees out of range, ** It is carried [about three cases when there is few components adsorption from 20 pieces] out in the mode from which the image pick-up of the passive circuit elements 842 after adsorption of all the planned passive circuit elements 842 differs, respectively.

[0170] A printed circuit board 408 may be equipped with passive circuit elements 842 in the different bearing from bearing at the time of being supplied by the passive-circuit-elements feeders 14 and 16 with the components adsorption shaft 766. A bearing modification include angle is an include angle for rotating passive circuit elements 842 to bearing at the time of wearing from bearing (bearing which does not include an error) at the time of supply (at the time of the components receipt of the components adsorption shaft 766), and it is beforehand set up in the wearing program according to the class of passive circuit elements 842, the wearing part, etc. In addition, although the bearing modification include angle is set up at the include angle which rotates the components adsorption shaft 766 to an one direction, actual angle of rotation and an actual direction are set up in the include angle and direction which rotate passive circuit elements 842 to bearing set up with the bearing modification include angle with the minimum angle of rotation.

[0171] First, ** is just explained to **. When the number of adsorption of passive circuit elements 842 is 20 pieces, as shown in drawing 30 , the 1st to the 15th passive circuit elements 842 are picturized in parallel to adsorption of the 6th to the 20th passive circuit elements 842, and bearing error include-angle theta1 a-theta 15a is acquired as an image recognition include angle. And if one pitch of intermittent body of revolution 762 is rotated from the condition in which the 20th components adsorption shaft 766 adsorbed passive circuit elements 842, the components adsorption shaft 766 which adsorbed passive circuit elements 842 the 1st can equip a printed circuit board 408 with return and passive circuit elements 842 in a components adsorption stowed position.

[0172] However, passive circuit elements 842 (16th [the] thru/or the 20th passive circuit elements 842 are called hereafter.) by which the 16th thru/or the 20th were adsorbed at the time of adsorption termination The same is said of the passive circuit elements 842 by which the 1st thru/or the 15th were adsorbed. Since the image pick-up is not performed if it attaches, When the bearing modification include angle of the 1st thru/or the 5th passive circuit elements 842 is within the limits of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees In parallel to wearing to the printed circuit board 408 of the 1st thru/or the 5th passive circuit elements 842, the image pick-up of the 16th thru/or the 20th passive circuit elements 842 is performed.

[0173] In this passive-circuit-elements wearing system 8, this is related to it being judged that the adsorption error occurred and trying not to be equipped, when passive circuit elements 842 incline across the range of **30 degrees to 0 times, 90 degrees, 180 degrees, and 270 degrees as a result of an image pick-up. In this passive-circuit-elements wearing system 8, the driven gear 800 fixed to 20 components adsorption shafts 766, respectively is clenched by the common driver 716, and when rotating the passive circuit elements 842 with which a printed circuit board 408 is equipped, other components adsorption shafts 766 are rotated in this direction whenever [isogonism]. Therefore, when wearing and an image pick-up are performed in parallel, in bearing of the passive circuit elements 842 picturized, not only the bearing error include angle of the passive-circuit-elements 842 self but the bearing modification include angle and bearing error amendment include angle of passive circuit elements 842 with which it is equipped in parallel are contained. The direction and magnitude of the bearing modification include angle of the passive circuit elements 842 with which it is equipped in parallel, and a bearing error amendment include angle under therefore, the simple regulation which is not taken into consideration In order to judge whether the excessive maintenance bearing error has occurred in the picturized passive circuit elements 842 It is required to suppose that the maintenance bearing error excessive when passive circuit elements 842 separate from the range of **alpha focusing on 0 times, 90 degrees, 180 degrees, and 270 degrees occurred. The magnitude of **alpha It should be determined in consideration of the bearing modification include angle and bearing error amendment include angle of passive circuit elements 842 with which it is equipped in parallel to the bearing error include angle of the passive circuit elements picturized. If a bearing error include angle and a bearing error amendment include angle consider the condition of the limit which is 0, alpha needs in fact to set it as the magnitude which excepts the range of 45**beta, the magnitude which excepts the very thing 45 degrees, then since a bearing error include angle and a bearing error amendment include angle are not 0, although it is good.

[0174] In this passive-circuit-elements wearing system 8, in almost all cases, a bearing error include angle is less than **5 times, and if it is not the case where a certain abnormalities occur, in consideration of the fact of not exceeding **10 degrees, **alpha is decided to be **30 degrees as follows. When the bearing modification include angle of the 1st thru/or the 5th passive circuit elements 842 is within the limits of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees, though it is rotated in case a printed circuit board 408 is equipped with the 1st thru/or the 5th passive circuit elements 842, in almost all cases, it is less than 20 degrees. For example, it is because the maintenance bearing error has arisen +5 times, and angle of rotation will turn into 20 degrees if a bearing modification include angle is -15 degrees. Therefore, angle of rotation of the passive circuit elements 842 picturized even if the maintenance bearing error has arisen +5 times in the passive circuit elements 842 picturized and it is rotated 20 degrees in addition to it is 25 degrees, and does not have **30 things become out of range. In addition, although angle of rotation of the passive circuit elements 842 picturized turns into a maximum of 35 degrees when the maintenance bearing error of the passive circuit elements 842 by which the maintenance bearing error of the passive circuit elements 842 of the 1st thru/or No. 5 is picturized +10 degrees is +10 degrees, such a thing hardly arises in practice, but the probability for passive circuit elements 842 to be discarded is very small noting that it is generated, although the adsorption error has not arisen, and it is satisfactory practically. Even if it is made to perform wearing and an image pick-up in parallel, it is almost convenient.

[0175] Thus, when wearing of the 1st thru/or the 5th passive circuit elements 842 and the image pick-up of the 16th thru/or the 20th passive circuit elements 842 are performed in parallel, The intermittent body of revolution 762 after 20 adsorption

termination of passive circuit elements 842 While XY robot does horizontal migration and a components adsorption stowed position is moved to up to the components wearing part of a printed circuit board 408, and carrying out 1 pitch intermittent rotation, the components adsorption shaft 766 is rotated by the surroundings of an own axis. While the components adsorption shaft 766 which adsorbed the 1st passive circuit elements 842 by that cause is moved to a components adsorption stowed position, passive circuit elements 842 are rotated to bearing which the maintenance bearing error was amended and was set up with the bearing modification include angle, and a printed circuit board 408 is immediately equipped with them after migration.

[0176] As shown in drawing 30 , total angle of rotation of the components adsorption shaft 766 holding the 1st passive circuit elements 842 is (-theta1 a+theta 1b), and the image recognition include angle of the 16th passive circuit elements 842 is set to (theta16a-theta1a+theta1b) including angle of rotation (- theta1a+theta1b) of the 1st passive circuit elements 842. Therefore, adsorption shaft total angle of rotation is set to include-angle (- theta16a+theta1a-theta1b) +theta16b which added own bearing modification include-angle theta16b to the include angle for canceling a bearing error include angle (theta16a-theta1a+theta1b) at the time of wearing of the 16th passive circuit elements 842. The same is said of the 17th thru/or the 20th passive circuit elements 842. Moreover, since the components adsorption shaft 766 of the 2nd henceforth is rotated by coincidence at the time of rotation of the components adsorption shaft 766 which equipped with passive circuit elements 842 previously, in addition to the bearing error include angle and bearing modification include angle of passive circuit elements 842 which self holds, based on angle of rotation and the direction of the components adsorption shaft 766 which equipped with passive circuit elements 842 previously, angle of rotation and the direction of the components adsorption shaft 766 are set up. This angle of rotation and direction are set up in the include angle and direction which rotate passive circuit elements 842 to bearing set up with the bearing modification include angle at an angle of min.

[0177] ** Explain. When the bearing modification include angle of the 1st thru/or the 5th passive circuit elements 842 is an include angle of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees out of range, in advance of the wearing initiation to the printed circuit board 408 of passive circuit elements 842, the image pick-up of these five passive circuit elements 842 is performed. Since passive circuit elements 842 lean **30 degrees or more and may be judged to be an adsorption error when the bearing modification include angle of the 1st thru/or the 5th passive circuit elements 842 is an include angle of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees out of range, it is not carried out if wearing and an image pick-up are concurrent.

[0178] Therefore, the image pick-up of the 16th thru/or the 20th passive circuit elements 842 is performed, while a wearing head is made to carry out horizontal migration by XY robot and a components adsorption stowed position is moved to up to the components wearing part of a printed circuit board 408, as shown in the timing diagram of drawing 25 . The components adsorption shaft 766 which adsorbed passive circuit elements 842 is moved to an image pick-up location side by the 1st from a components adsorption stowed position to 4 pitch detached building ****** by rotating the intermittent body of revolution 762 part 90 degrees for five pitches for this image pick-up. Therefore, after the 20th image pick-up of passive circuit elements 842, the intermittent body of revolution 762 is rotated by four pitches to hard flow, and the components adsorption shaft 766 which adsorbed passive circuit elements 842 the 1st is moved to a components adsorption stowed position. Moreover, while the 1st components adsorption shaft 766 is rotated by the surroundings of an own axis in parallel to this migration and the maintenance bearing error of passive circuit elements 842 is amended, it is rotated to bearing set up with the bearing modification include angle.

[0179] Under the present circumstances, while the intermittent body of revolution 762 will be rotated during the horizontal migration of a wearing head as shown in the timing diagram of drawing 25 if the time amount which the image pick-up of the 16th thru/or the 20th passive circuit elements 842 takes is shorter than the time amount which the horizontal migration of a wearing head takes, the components adsorption shaft 766 is made to rotate. If the direction of imaging time excels, while the intermittent body of revolution 762 is rotated also after horizontal migration termination of a wearing head, the components adsorption shaft 766 will be rotated.

[0180] As shown in drawing 31 , the bearing error include angle of the 1st passive circuit elements 842 is theta1a degree, and in order to amend an error, it is required to make it rotate -theta1 a times. Moreover, theta1b degree, then passive circuit elements 842 make a bearing modification include angle rotated whenever [total (-theta1 a+theta 1b)]. The same is said of the passive circuit elements 842 of the 2nd henceforth, and the components adsorption shaft 766 is rotated in parallel to being moved to a components adsorption stowed position by rotation of one pitch of the intermittent body of revolution 762. It is the same as the case of ** that angle of rotation and the direction of the components adsorption shaft 766 are set up about the components adsorption shaft 766 of the 2nd henceforth based on angle of rotation and the direction of the components adsorption shaft 766 which equipped with passive circuit elements 842 previously.

[0181] ** Explain. If the number of the passive circuit elements 842 with which it equips makes N individual the number of all the passive circuit elements 842 to which it sticks 15 pieces thru/or 19 cases By counting from a head, if the bearing modification include angle of the passive circuit elements 842 of an individual (N-15) is an include angle of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees out of range Like the case of the aforementioned **, after adsorption of all planned numbers of passive circuit elements 842, after an image pick-up is performed about all the passive circuit elements 842, the components adsorption shaft 766 which adsorbed passive circuit elements 842 the 1st is returned to a components adsorption stowed position, and it equips with passive circuit elements 842.

[0182] In addition, when the number of the passive circuit elements 842 to which it sticks is 15, (N-15) is 0, the attainment to the image pick-up location of passive circuit elements 842 and the attainment to a components adsorption stowed position do not take place in parallel, and a line crack and all the passive circuit elements 842 are picturized for the intermittent rotation without wearing 5 times after components adsorption termination. It is also the same as when the bearing modification include angle of passive circuit elements 842 is within the limits of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees.

[0183] By counting from a head, if the bearing modification include angle of the passive circuit elements 842 of an individual (N-15) is within the limits of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees Until the components

adsorption shaft 766 which adsorbed passive circuit elements 842 reaches the 1st to a components adsorption stowed position by intermittent rotation of the intermittent body of revolution 762 After a line crack and the 1st passive circuit elements 842 reach [the image pick-up of the passive circuit elements 842 which the components adsorption shaft 766 which reached the image pick-up location holds] a components adsorption stowed position, wearing and an image pick-up are performed in parallel. Only an image pick-up is ********** (20-N). If it puts in another way, intermittent rotation without wearing of a time (20-N) will be performed.

[0184] For example, while a line crack and the 1st passive circuit elements 842 are moved by intermittent rotation of the intermittent body of revolution 762 without wearing of passive circuit elements 842 toward a components adsorption stowed position after adsorption of all the passive circuit elements 842 3 times as shown in drawing 32 when the number of the passive circuit elements 842 with which it is equipped is 17, the 13th thru/or the 15th passive circuit elements 842 are picturized. Since the 1st passive circuit elements 842 arrive at a components adsorption stowed position by rotation of 4 pitch eye, while the components adsorption shaft 766 is rotated by the surroundings of an own axis between this intermittent rotation and the maintenance bearing error of passive circuit elements 842 is amended, it is rotated to bearing set up with the bearing modification include angle. The image pick-up of the 16th and the 17th passive circuit elements 842 will be performed in parallel to wearing of the 1st and the 2nd passive circuit elements 842, and angle of rotation of the 1st and the 2nd passive circuit elements 842 will be contained in those image recognition include angles.

[0185] After 17 adsorption of passive circuit elements 842, a wearing head is made to carry out horizontal migration, and is moved to up to a printed circuit board 408. If the image pick-up of the 13th thru/or the 15th passive circuit elements 842 is performed in the meantime and an image pick-up is completed before horizontal migration, in parallel to horizontal migration, the migration to a components adsorption stowed position and rotation of the 1st components adsorption shaft 766 will be performed. If the direction of imaging time excels, while an image pick-up will be performed also after termination of the horizontal migration of a wearing head, rotation of the circumference of the revolution to the components adsorption stowed position of the 1st components adsorption shaft 766 and an own axis will be performed.

[0186] When the number of the passive circuit elements 842 with which it is equipped is 14 or less, wearing and an image pick-up are not performed in parallel, the intermittent body of revolution 762 is made to carry out intermittent rotation of six or more cases [14 or less] 5 times after adsorption of all the passive circuit elements 842, and all the passive circuit elements 842 are picturized. Moreover, when the number of the passive circuit elements 842 with which it is equipped is five or less, the intermittent body of revolution 762 is made to carry out intermittent rotation only of the number of passive circuit elements 842. However, the components adsorption shaft 766 with which the passive circuit elements 842 equipped with five or less cases adsorbed passive circuit elements 842 the 1st even if it all adsorbed does not reach an image pick-up location. Therefore, after all the passive circuit elements 842 adsorb, the intermittent body of revolution 762 is rotated a part for the pitch between the location in which passive circuit elements 842 are located, and an image pick-up location, and at once in order to move the components adsorption shaft 766 which adsorbed passive circuit elements 842 the 1st to an image pick-up location, after that, the intermittent body of revolution 762 is made to carry out N time intermittent rotation, and an image pick-up is performed.

[0187] Thus, if an image pick-up is performed in parallel to the horizontal migration of the intermittent body of revolution 762 and an image pick-up is completed before horizontal migration also when the number of the passive circuit elements 842 with which it is equipped is 14 or less, the intermittent body of revolution 762 is rotated in parallel to horizontal migration, and it will be rotated by the surroundings of an own axis while the 1st components adsorption shaft 766 is moved to a components adsorption stowed position. If an image pick-up is completed after horizontal migration, the 1st components adsorption shaft 766 will be rotated by the surroundings of an own axis with migration pan ****** to a components adsorption stowed position after termination of an image pick-up. Moreover, after image pick-up termination, when making the 1st move the components adsorption shaft 766 which adsorbed passive circuit elements 842 to a components adsorption stowed position, the hand of cut of the intermittent body of revolution 762 is set up in the direction which there is least angle of rotation and ends.

[0188] In this operation gestalt, the components adsorption shaft 766 is a components adsorption implement which is a kind of a components holder, the components maintenance shaft which is a kind of a components holder is constituted, and the components adsorption nozzle 784 constitutes the components attaching part slack components adsorption section of the components adsorption shaft 766 so that clearly from the above explanation. The part which the servo motor 742 for revolution and the servo motor 742 for revolution of a control device 1050 are controlled [part], and carries out intermittent rotation of the intermittent body of revolution 762 constitutes the holder pointing device which carries out sequential positioning of the 20 components adsorption shafts 766 in a components adsorption stowed position and an image pick-up location, and the XY robot 662,664 which has the migration member slack X-axis slide 654,656 for conveyance constitutes the migration equipment for conveyance. The presser-foot section 570,572 of the ramp 598 of the Maine conveyor 400,402, the ramp lifting device 600, the substrate adsorption implement 602, and the interior material 566,568 of a proposal constitutes the circuit base material supporting structure. Moreover, the intermittent body of revolution 762, the driven pulley 740, and the adsorption implement slewing gear whose driving pulley 744 grade is a kind of a holder slewing gear in the above-mentioned holder pointing device are constituted. Said migration equipment for conveyance holds a holder slewing gear, and moves, and the adsorption implement slewing gear constitutes adsorption implement migration equipment with XY robot. Furthermore, a linear motor 886 constitutes the rise-and-fall driving gear which makes it go up and down the rise-and-fall driving member 892, and constitutes the lifting device according to individual which makes it go up and down the components adsorption shaft 766 located with the rise-and-fall driving member 892 near the components adsorption stowed position which is a components receipt stowed position. The cam member slack fixed cam 712, the cam follower 804, and the compression coil spring 806 constitute the lifting device which makes it go up and down a components holder along with a migration locus. The part which makes the passive circuit elements 842 supplied to the components adsorption shaft 766 from the passive-circuit-elements feeders 14 and 16 in the components adsorption stowed position of a control unit 1050 receive, or makes a printed circuit board 408 equip with passive circuit elements 842 constitutes the receipt wearing control

unit. A control unit 1050 controls a holder slewing gear, the migration equipment for conveyance, an individual lifting device, and a receipt wearing control unit. Furthermore, two or more components adsorption shaft 766, holder slewing gears, migration equipment for conveyance, individual lifting devices, and receipt wearing control units constitute a wearing unit, two sets of wearing units are prepared in this operation gestalt, the wearing unit which is these [of a control unit 1050] two sets is controlled, and the part into which the receipt of passive circuit elements 842 and wearing are made to perform by turns constitutes the mutual wearing control means. The part which amends the migration length of the migration equipment for conveyance based on the maintenance position error of the passive circuit elements 842 with the components adsorption shaft 766 of a control unit 1050, and amends positioning to the circuit base material supporting structure of a holder slewing gear constitutes the positioning amendment means. Furthermore, a driver 716, a driven gear 800, and the servo motor 724 for driving source slack bearing amendment modification constitute a holder slewing gear, a holder slewing gear is controlled based on the maintenance bearing error of the passive circuit elements 842 of a control unit 1050, and the part which amends a maintenance bearing error constitutes the bearing amendment means. Moreover, as explained based on drawing 30 and drawing 32 , the part into which wearing of the passive circuit elements 842 with the components adsorption shaft 766 of a control unit 1050 and the image pick-up of the passive circuit elements 842 by passive-circuit-elements image pick-up equipment 820 are made to perform in parallel constitutes the concurrency image pick-up control means. The intermittent body of revolution 762 is a migration member which moves in the direction which holds the shank material of a components holder movable and pivotable to shaft orientations, and intersects the axis of the shank material, and is also the component of the passive-circuit-elements transport device which conveys passive circuit elements by intermittent rotation. The part which controls the main air cylinders 930 and 974 of a control unit 1050 and the auxiliary air cylinder 984 constitutes an actuator control unit. Furthermore, with these main air cylinders 930 and 974 and auxiliary air cylinder 984 grade The adsorption implementation condition that the pressure change-over valve 860 moves the change-over member 874 to the negative pressure supply location which switches the pressure in the components adsorption nozzle 784 to negative pressure more than from atmospheric pressure with the rise-and-fall driving member 892 dropping the components adsorption nozzle 784, For the rise-and-fall driving member 892 to drop the components adsorption nozzle 784 It follows and the change-over valve control unit 882 which can be switched is constituted in the release implementation condition that the pressure change-over valve 860 moves the change-over member 874 to the negative pressure discharge location which switches the pressure in the components adsorption nozzle 784 to the pressure more than atmospheric pressure from negative pressure. Moreover, a link 1030 and rollers 1036 and 1042 constitute the transport unit which makes reverse the migration direction of the rise-and-fall driving member 892, and is transmitted to the migration member 1034. When the actuation load with which the **** coil spring 1006 which energizes the operation member 1002 is given to the operation member 1002 by the main air cylinder 974 and the auxiliary air cylinder 984 exceeds the set point The relative-displacement permission equipment which permits that the operation member 1002 is displaced relatively to an air cylinder 974,984, giving elastic resistance is constituted, and the compression coil spring 962 which energizes the operation member 952 constitutes relative-displacement permission equipment similarly. The positive pressure supply path where paths 1020 and 1022 were formed in the operation member 1002 is constituted, it is formed in the pressure change-over valve 860, and the path to which it is made open for free passage by paths 1020 and 1022, and air is supplied also constitutes the positive pressure supply path with paths 1020 and 1022.

[0189] The 1st thru/or another operation gestalt in common to the 5th, 8th, and 9th invention are shown at drawing 33 thru/or drawing 37 . This operation gestalt makes only the include angle which will be in the condition that a conveyance flat surface and one bus-bar of a conical surface cross at right angles the above-mentioned fixed pivot line to the perpendicular to a conveyance flat surface, in it about two or more components adsorption shafts at it while each of two or more bus-bars of the conical surface used as a center line makes the fixed pivot line of two or more components adsorption shafts hold in the condition of becoming an axis, to intermittent body of revolution incline. Other configurations are the same as said operation gestalt, and only a different part is explained.

[0190] The XY robot 1102 does horizontal migration of the wearing head 1100 like said wearing head 650,652. Two or more members of each other are fixed, and the X-axis slide 1104 which constitutes the XY robot 1102 changes, as shown in drawing 33 . One of two or more of the members is the supporter-ed material 1106, and while the guide block 1108 of the interior material slack pair of a proposal-ed is fixed, fitting of it is carried out to the interior material slack guide rail 1110 of a proposal of the pair prepared in the Y-axis slide which is not illustrated movable. It is screwed in the **** shaft 1114 attached in the Y-axis slide pivotable while a nut 1112 is fixed to the supporter-ed material 1106. These nuts 1112 and the **** shaft 1114 constitute the ball thread. Rotation of the X-axis servo motor 1116 is transmitted to the screw-thread shaft 1114 by coupling 1118, the **** shaft 1114 is rotated, and the X-axis slide 1104 is moved to X shaft orientations. Even if it ****s coupling 1118 with the output shaft 1120 of the X-axis servo motor 1116 and a gap is in each axis with a shaft 1114, absorbing the gap, it ****s rotation of the X-axis servo motor 1116, and transmits it to a shaft 1114.

[0191] it is shown in the end section of X shaft orientations of the supporter-ed material 1106 at drawing 33 and drawing 35 -- as -- the attachment section 1124 of a pair -- a lower part -- and it protrudes on the sense which goes to the other end side of X shaft orientations (only one side is illustrated by drawing 33), and the supporter material 1126 is being fixed to these attachment section 1124. As shown in drawing 33 and drawing 34 , the supporter material 1126 has the arm 1127 of a pair, and is being fixed to the supporter-ed material 1106 also in these arms 1127. Moreover, it is fixed to the sense to which the attachment member 1128 begins to extend below in the other end of X shaft orientations of the supporter-ed material 1106.

[0192] As shown in drawing 33 , the revolving shaft 1132 is attached in the supporter material 1126 pivotable by two or more bearing 1134. In addition, the part which two or more members of each other are fixed, and the supporter material 1126 changes, and supports the upper part of the revolving shaft 1132 of the supporter material 1126 pivotable is being fixed removable to the part fixed to the supporter-ed material 1106 of the supporter material 1126 on account of assembly.

[0193] The driven pulley 1136 is being fixed to the lower part of a revolving shaft 1132. Rotation of the servo motor 1138 for driving source slack revolution attached in the supporter material 1126 with the bracket 1137 is transmitted to the driven

pulley 1136 by a driving pulley 1140 and the timing belt 1142, and arbitration is made for a revolving shaft 1132 to carry out include-angle rotation by forward reverse both directions.
[0194] Fitting of the hollow shaft 1148 is carried out to the revolving shaft 1132 pivotable through bearing 1146. The drive bevel gear 1150 as a driver is fixed to the lower limit section of a hollow shaft 1148, and the driven pulley 1152 is being fixed to the upper limit section. Rotation of the servo motor 1154 for driving source slack bearing amendment modification attached in the supporter material 1126 is transmitted to the driven pulley 1152 by a driving pulley 1156 and the timing belt 1158, and arbitration is made for the drive bevel gear 1150 to carry out include-angle rotation by forward reverse both directions.
[0195] The components adsorption shaft attachment component 1162 is fixed to the protrusion edge from the hollow shaft 1148 of a revolving shaft 1132 to a lower part, and the intermittent body of revolution 1164 is constituted with the revolving shaft 1132 at it. 16 maintenance holes 1166 are formed in the components adsorption shaft attachment component 1162 (two pieces are illustrated by drawing 33). These maintenance hole 1166 is formed considering each of 16 bus-bars of the conical surface which uses axis of rotation of a revolving shaft 1132 as a center line as a center line, and to the perpendicular to the conveyance flat surface where axis of rotation is level, the revolving shaft 1132 is attached in said supporter material 1126, after only the include angle from which one bus-bar of the above-mentioned conical surface will be in the condition of intersecting perpendicularly with a conveyance flat surface has inclined. Said servo motor 1138 for revolution and the servo motor 1154 for bearing amendment modification are also attached in the supporter material 1126 in the condition of having inclined in the sense from which each axis of rotation becomes respectively parallel to axis of rotation of a revolving shaft 1132.
[0196] As shown in drawing 37 , fitting of the sleeve 1168 is carried out and it is being fixed to each of the above-mentioned maintenance hole 1166. It is being fixed to the components adsorption shaft attachment component 1162 with the fixed means slack bolt (illustration abbreviation) in the attachment section 1172 while fitting of the sleeve 1168 is carried out to the maintenance hole 1166. The field where the attachment section 1172 of the components adsorption shaft attachment component 1162 is fixed is made into a flat surface, and constitutes the peripheral face of a multiple drill.
[0197] Fitting of the rotation member 1178 is carried out to the sleeve 1168 pivotable through bearing 1176. The nut 1186 is screwed in the male screw section 1184, while the contact section 1180 of a major diameter is formed in the lower limit section of the rotation member 1178 and fitting of the driven bevel gear 1182 as a driven gear is carried out to the upper limit section. On both sides of the bearing 1176 of a pair, it is fixed to the rotation member 1178 between the contact sections 1180, and the driven bevel gear 1182 is clenched by said drive bevel gear 1150.
[0198] Fitting of the components adsorption shaft 1170 is carried out to the rotation member 1178. The components adsorption shaft 1170 has the shank material 1190 and the components adsorption nozzle 1194 attached in the shank material 1190 by the adapter 1192, and fitting of the relative displacement of the shank material 1190 to shaft orientations is made possible to the rotation member 1178. The nozzle attaching part 1196 of a major diameter is formed in the lower limit section projected from the rotation member 1178 of the shank material 1190. The upper limit section of the shank material 1190 is made to project from the rotation member 1178, bearing 1200 is attached by the attachment member 1198, and the components adsorption shaft 1170 is energized upwards by the compression coil spring 1202 as an elastic member which is a kind of the energization means arranged between bearing 1200 and said nut 1186. Whenever [to the upper part based on the energization force of the compression coil spring 1202 of the components adsorption shaft 1170 / motion limit] is prescribed by when the nozzle attaching part 1196 contacts the friction ring 1204 fixed to the inferior surface of tongue of the contact section 1180 of the rotation member 1178. The friction ring 1204 is made with the ingredient with high coefficient of friction (for example, rubber), and rotation of the rotation member 1178 is transmitted to the shank material 1190 by the friction engagement to the friction ring 1204 and the nozzle attaching part 1196.
[0199] The fitting hole 1210 of the ** with a stage which carries out opening is established in an inferior surface of tongue, and fitting of the adapter 1192 is carried out to shaft orientations movable at the nozzle attaching part 1196. An adapter 1192 is energized by the sense which projects from the nozzle attaching part 1196 to a lower part by the compression coil spring 1214 as an elastic member which is a kind of an energization means while it is held by two or more attachment components 1212 attached in the nozzle attaching part 1196 at the equiangular distance.
[0200] While two or more notching 1216 prolonged in parallel with the axis of the shank material 1190 is formed in an equiangular distance and fitting of each of two or more of said attachment components 1212 is carried out to the nozzle attaching part 1196 rotatable, it is held at the nozzle attaching part 1196 by the spring member 1218 of the shape of a ring twisted around the nozzle attaching part 1196. While the projected part 1220 which projects in the core side of the nozzle attaching part 1196 is formed in the part bottom by which fitting was carried out to the notching 1216 of an attachment component 1212, fitting is carried out to the notching 1222 formed in the nozzle attaching part 1196, and an attachment component 1212 is right-angled to that longitudinal direction focusing on the contact section to the base of the notching 1222 of this projected part 1220, and it is rotatable to the circumference of the axis prolonged in the tangential direction to the part in which the attachment component 1212 of the components adsorption shaft 1170 was attached. Furthermore, a control unit 1224 protrudes on the projected part 1220 bottom of an attachment component 1212, and fitting is carried out to the notching 1226 formed in the nozzle attaching part 1196. Rotation of the circumference of the axis to which the axis of the components adsorption shaft 1170 and an attachment component 1212 cross at right angles by fitting to notching 1216 and fitting to the notching 1226 of a control unit 1224 is prevented.
[0201] Fitting of the lower part of an attachment component 1212 is carried out to the notching 1232 formed in the engagement section 1230 of the major diameter of an adapter 1192, and it has prevented relative rotation with the nozzle attaching part 1196 and an adapter 1192. Moreover, the engagement projected part 1234 which projects to an adapter 1192 side protruded on the lower limit section of an attachment component 1212, and when this engagement projected part 1234 engages with the engagement section 1230 from a lower part, the extract from the fitting hole 1210 of an adapter 1192 is prevented. An adapter 1192 can be removed from the nozzle attaching part 1196 by pushing said control unit 1224 in this condition, resisting the energization force of the spring member 1218, rotating an attachment component 1212, and solving

engagement in the engagement projected part 1234 and the engagement section 1230.
[0202] The components adsorption nozzle 1194 has the adsorption tubing 1242 held at the adsorption tubing supporter 1240, and it is held by the spring member 1248 at the adapter 1192 while taper fitting is carried out to the tapered bore 1246 established in the adapter 1192 in the taper section 1244 prepared in the adsorption tubing supporter 1240. The spring member 1248 accomplishes the typeface of KO mostly, fitting is carried out to the notching 1252 of the pair formed in the adapter 1192 in the arm of the pair of the character of KO, like the tip, distance between these arms is narrowed, and it becomes tight, and it is made selfish. Moreover, the point between these arms is bent by the sense which approaches mutually, and omission from an adapter 1192 are prevented.
[0203] If fitting of the taper section 1244 is carried out to a tapered bore 1246, the spring member 1248 is inserted in the fitting slot 1254 of the shape of a circular ring formed in the taper section 1244, and it will draw in a tapered bore 1246 and it will be positioned while it engages with the taper section 1244 and holds the adsorption tubing supporter 1240. The attaching position to the adapter 1192 of the spring member 1248 is in the condition that fitting of the taper section 1244 was carried out to the tapered bore 1246, and is made into the location which will be in the condition that the center position of the fitting slot 1254 of a hemicycle cross section shifted below to the center position of the cross section of the circle configuration of the spring member 1248, and the spring member 1248 engages with the part of the slot side-face top of the fitting slot 1254, and draws the adsorption tubing supporter 1240 in a tapered bore 1246. A sign 1256 is the reflecting plate of the components adsorption nozzle 1194. Thus, the components adsorption nozzle 1194 held at the adapter 1192 is detached and attached to every adapter 1192 and the shank material 1190.
[0204] Corresponding to each of 16 components adsorption shafts 1170, 16 pressure change-over valves 1260 are being fixed to the peripheral face of the components adsorption shaft attachment component 1162. The pressure change-over valve 1260 has the change-over member 1261, and is being fixed to the axis of the components adsorption shaft 1170, and parallel. The pressure change-over valve 1260 is connected to the vacuum devices which are not illustrated through the in-a-circle path 1268 grade formed in the path 1262 formed in the components adsorption shaft attachment component 1162, the paths 1264 and 1266 formed in the revolving shaft 1132, and the supporter material 1126 as shown in drawing 33 and drawing 37 .
[0205] The pressure change-over valve 1260 is connected to the path 1282 formed in the shank material 1190 of the components adsorption shaft 1170 of another path 1270 formed in the components adsorption shaft attachment component 1162, the path 1272 formed in the sleeve 1168, the path 1276 formed in the seal attachment component 1274, and the path 1280 formed in the rotation member 1178 as shown in drawing 37 . A path 1282 is maintained at the condition that it was open for free passage with the path 1280 even if it is long to shaft orientations while a path 1280 constitutes the shape of a circular ring, and the components adsorption shaft 1170 moves to rotation and shaft orientations to the rotation member 1178.
[0206] The location where the axis of the components adsorption shaft 1170 will be in the condition of intersecting perpendicularly with a level conveyance flat surface, among the halt locations of 16 pieces of the components adsorption shaft 1170 is a components adsorption stowed position, and let the location distant from the components adsorption stowed position 90 degrees be an image pick-up location. When the components adsorption shaft 1170 is revolved by intermittent rotation of the intermittent body of revolution 1164, the location where the location of 1170 becomes the lowest is made into a components adsorption stowed position, and let the location higher than it be an image pick-up location. As shown in drawing 36 , passive-circuit-elements image pick-up equipment 1290 is being fixed to the location corresponding to the image pick-up location of said supporter material 1126 with the bracket 1288. Passive-circuit-elements image pick-up equipment 1290 is constituted like said passive-circuit-elements image pick-up equipment, and is equipped with the lighting system, the reflector 1294, and CCD camera 1296 which are not illustrated. In an image pick-up location, the axis of the components adsorption shaft 1170 inclines to the perpendicular to a conveyance flat surface, and passive-circuit-elements image pick-up equipment 1290 is formed in the sense from which the optical axis becomes right-angled with the axis of the components adsorption shaft 1170. Passive-circuit-elements image pick-up equipment 1290 is made to incline also to a level conveyance flat surface, as shown in drawing 33 .
[0207] As shown in drawing 34 , reference mark image pick-up equipment 1300 is carried in the attachment member 1128 which constitutes the X-axis slide 1104. As shown in the attachment member 1128 again at drawing 33 , the principal part of the individual lifting device 1302 and the change-over valve control unit 1304 is attached in the part corresponding to a components adsorption stowed position. The linear motor 1310 is attached in the attachment member 1128, and the rise-and-fall driving member 1316 is being fixed to the migration member 1314 fixed to the needle 1312 of a linear motor 1310. The rise-and-fall driving member 1316 has the rise-and-fall mechanical-component slack engagement member 1318 which projects to the upper part of the components adsorption shaft 1170 positioned in the components adsorption stowed position.
[0208] The change-over valve control unit 1304 is constituted like said change-over valve control unit 882, and in order to switch the pressure change-over valve 1260 to a negative pressure supply location, the operation member 1322 moved to an operation location and a non-acting location by the main actuator slack main air cylinder 1320 and the main air cylinder 1320 is attached in the migration member 1314. Although illustration is omitted to the attachment member 1128 again The main actuator slack main air cylinder, an auxiliary actuator slack auxiliary air cylinder, a migration member, an operation member, etc. for switching the pressure change-over valve 1260 to a negative pressure discharge location are attached. When the migration member 1314 is moved by the linear motor 1310, Two migration members synchronize mechanically and it moves to the reverse sense mutually, and two operation members go up and down to the symmetry mutually, act on the change-over member 1261 alternatively, and switch the pressure change-over valve 1260 to a negative pressure supply condition and a negative pressure discharge condition.
[0209] In the passive-circuit-elements wearing system constituted as mentioned above, in said operation gestalt, similarly, two or more components adsorption shafts 1170 are moved to a passive-circuit-elements feeder, and passive circuit elements are adsorbed, and it is moved by the XY robot's 1102 actuation, and intermittent rotation of the intermittent body

of revolution 1164 to up to a printed circuit board, and equips with passive circuit elements after adsorption by them at the time of wearing of passive circuit elements.
[0210] At the time of adsorption of passive circuit elements, 16 components adsorption shafts 1170 are moved one by one to a components adsorption stowed position by intermittent rotation of the intermittent body of revolution 1164. The drive bevel gear 1150 is rotated by the intermittent body of revolution 1164 and this direction at an isogonism rate, and it is made for the components adsorption shaft 1170 not to rotate around an own axis at this time. After the components adsorption shaft 1170 reaches to a components adsorption stowed position, the rise-and-fall driving member 1316 is dropped by descent of the migration member 1314, and the components adsorption shaft 1170 is dropped. Although the nozzle attaching part 1196 of the shank material 1190 will separate from the friction ring 1204 if the components adsorption shaft 1170 is dropped, the components adsorption shaft 1170 does not rotate to the rotation member 1178. For example, if torsion arises in the compression coil spring 1202, the running torque which rotates the components adsorption shaft 1170 to the rotation member 1178 will arise, but since the end section of the compression coil spring 1202 is supported through bearing 1200 with the components adsorption shaft 1170, the compression coil spring 1202 rotates to the components adsorption shaft 1170, and is not rotated by the components adsorption shaft 1170.
[0211] The pressure change-over valve 1260 is switched to a negative pressure supply condition in the middle of descent of the components adsorption shaft 1170, negative pressure is supplied to the components adsorption nozzle 1194, and passive circuit elements are adsorbed. After adsorption, if the rise-and-fall driving member 1316 is raised, the components adsorption shaft 1170 will be raised by the energization force of the compression coil spring 1202, and passive circuit elements will be taken out from a feeder.
[0212] If the components adsorption shaft 1170 which adsorbed passive circuit elements reaches an image pick-up location by rotation of the intermittent body of revolution 1164, passive circuit elements will be picturized by passive-circuit-elements image pick-up equipment 1290. In said operation gestalt, wearing and an image pick-up are similarly performed separately according to the magnitude of the bearing modification include angle of the number of the passive circuit elements with which it is equipped and the 1st thru/or the 4th passive circuit elements.
[0213] At the time of wearing of passive circuit elements, two or more components adsorption shafts 1170 are positioned one by one in a components adsorption stowed position. When passive circuit elements are moved for the components adsorption shaft 1170 with which a printed circuit board is equipped to a components adsorption stowed position by intermittent rotation of the intermittent body of revolution 1164, While the drive bevel gear 1150 is made to carry out relative rotation to the intermittent body of revolution 1164 during rotation of the intermittent body of revolution 1164, the components adsorption shaft 1170 is rotated by the surroundings of an own axis and the maintenance bearing error of passive circuit elements is amended Passive circuit elements are rotated to bearing set up with the bearing modification include angle. Rotation of the drive bevel gear 1150 is transmitted to the components adsorption nozzle 1194 from the driven bevel gear 1182, the rotation member 1178, the friction ring 1204, the nozzle attaching part 1196, an attachment component 1212, and an adapter 1192, and is rotated by passive circuit elements. After reaching to the components adsorption stowed position of the components adsorption shaft 1170, the rise-and-fall driving member 1316 is dropped, the components adsorption shaft 1170 is dropped, and a printed circuit board is equipped with passive circuit elements. Moreover, the pressure change-over valve 1260 is switched to a negative pressure discharge condition by descent of the migration member 1314, after contacting to the printed circuit board of passive circuit elements, air is supplied to the components adsorption nozzle 1194, and passive circuit elements are released. It is the same also in said operation gestalt that the rise-and-fall distance of the components adsorption shaft 1170 and the change-over stage to the negative pressure discharge condition of the pressure change-over valve 1260 are changed into two kinds according to the height of passive circuit elements.
[0214] It is made to go up and down in this passive-circuit-elements wearing system, when the intermittent body of revolution 1164 is rotated since the fixed pivot line common to two or more components adsorption shafts 1170 is made to incline to the perpendicular to a conveyance flat surface, the components adsorption shaft 1170 being revolved (it approaches and estranges to a level conveyance flat surface). The location of the components adsorption shaft 1170 becomes the lowest in a components adsorption stowed position. An image pick-up location is higher than a components adsorption stowed position, and passive-circuit-elements image pick-up equipment 1290 can be formed in the clearance obtained by rise of the components adsorption shaft 1170. Avoiding interference with the passive circuit elements held with passive-circuit-elements image pick-up equipment 1290, the components adsorption shaft 1170, and the components adsorption shaft 1170, and interference with passive-circuit-elements image pick-up equipment 1290 and a passive-circuit-elements feeder Rise-and-fall distance of the components adsorption shaft 1170 in a components adsorption stowed position can be shortened. Moreover, since passive-circuit-elements image pick-up equipment 1290 is made to incline also to a level conveyance flat surface, its dimension in a direction right-angled at the conveyance flat surface of passive-circuit-elements image pick-up equipment 1290 is small as compared with the case where set an image pick-up location as the location which becomes a posture with the level components adsorption shaft 1170, and passive-circuit-elements image pick-up equipment 1290 is formed in a right angle to a conveyance flat surface, it can end, can constitute X-axis slide 1104 in a compact, and can make a bearer rate high.
[0215] in addition, in previous explanation, it is the same, the path of each adsorption tubing 788 is made the same, and a class shows 20 components adsorption nozzles 784 roughly to drawing 16 -- like -- etc. -- every ten components adsorption nozzles 1330 and 1332 from which the path of adsorption tubing differs in two kinds of size as roughly shown in drawing 38 although prepared in include-angle spacing -- an equiangular distance -- and you may prepare by turns. In addition, the reflecting plate of the components adsorption nozzles 1330 and 1332 is illustrated by drawing 38 . As roughly shown in drawing 39 , the path of adsorption tubing may bring near the same components adsorption nozzles, and may form these components adsorption nozzles 1330 and 1332.
[0216] Furthermore, as shown in drawing 40 , it is also possible to form three kinds of components adsorption nozzles 1340, 1342, and 1344 from which the path of adsorption tubing differs. What is necessary is to set and resemble one maintenance hole about the components adsorption shaft with which the path of adsorption tubing has a large components adsorption

nozzle, or just to fit in for setting more than one regardless of the path of adsorption tubing, if the diameter of the shank of a components adsorption shaft is the same and fitting in a common maintenance hole is possible. What is necessary is just to have two or more kinds [body of revolution / intermittent] according to the path of the shank of a components adsorption shaft of maintenance holes, if the paths of the shank of a components adsorption shaft differ according to the path of adsorption tubing and a common maintenance hole cannot be used. The path of adsorption tubing shall have a large components adsorption nozzle for all the components adsorption shafts made to hold to intermittent body of revolution like the components adsorption nozzle 1344 further again, and a components adsorption shaft may be prepared in a ten-piece equiangular distance. The components adsorption shaft with which the components adsorption nozzle which has adsorption tubing of a still larger path than the components adsorption nozzle 1344 was attached may be established. Furthermore, four or more kinds of components adsorption nozzles may be prepared. If the components adsorption nozzle which has adsorption tubing of a path according to the magnitude of passive circuit elements is prepared, since large passive circuit elements will also be held certainly, even if it does not make low intermittent rotational speed of intermittent body of revolution, passive circuit elements do not shift and decline in wearing efficiency can be avoided.

[0217] In addition, it sets in said operation gestalt, and although the variable-aperture valve 1026 which adjusts the amount of flush of the air from the components adsorption implement after the pressure increase in a components adsorption implement was formed in the pressure change-over valve 860 and the serial, as shown in drawing 41 , it may be prepared in the pressure change-over valve 1400 and juxtaposition. For example, while making atmospheric air open for free passage a part of part to which the air of the pressure change-over valve 1400 is supplied, the variable-aperture valve 1402 as a variable-aperture means is formed. before a contact member contacts a change-over member -- electromagnetism -- if the closing motion valve 1404 is opened, it extracts from the air source of supply 1406, air is supplied through 1408 (a white round head expresses the contact to a contact member and a change-over member among drawing) and the pressure change-over valve 1400 is switched to a negative pressure discharge condition, air will be supplied to the adsorption tubing 1410. Many of air is supplied to the adsorption tubing 1410, after pressure increase, the flow rate of the air which flows out of the variable-aperture valve 1402 into atmospheric air increases, and the air of the suitable amount for making passive circuit elements estrange is supplied to the adsorption tubing 1410 until the pressure of the adsorption tubing 1410 becomes more than the atmospheric pressure near the atmospheric pressure.

[0218] If the amount of flush of the air from the adsorption tubing 1410 when strengthening wire drawing of the variable-aperture valve 1402 and the pressure of the adsorption tubing 1410 becomes more than the atmospheric pressure near the atmospheric pressure (when lessening the ullage of air) increases and a diaphragm is weakened, the amount of flush of the air from the adsorption tubing 1410 will decrease. If the pressure change-over valve 1400 is formed about each of 20 components adsorption shafts, changes the class of passive circuit elements with which it equips and are exchanged in a components adsorption nozzle, it will adjust the amount of drawing of the variable-aperture valve 1402 according to the path of adsorption tubing of the components adsorption nozzle. It is made to estrange from adsorption tubing quickly and certainly, without supplying the air of an amount according to the path of adsorption tubing by that cause, and passive circuit elements being blown away by a lot of air.

[0219] In addition, while adjusting the ullage of air by the variable-aperture valve 1402, diaphragm 1408 is made into a variable aperture, and if the flow rate of the air supplied from an air source of supply is also adjusted, the ratio of the flow rate of the air to the components adsorption nozzle after the pressure increase immediately after a change-over in the negative pressure discharge condition of a pressure change-over valve and in a components adsorption nozzle can be adjusted much more correctly.

[0220] Moreover, in said operation gestalt, although a slot 1016 is formed in the contact member 1014 and the contact member 1014 was making atmospheric air open path 1022 grade for free passage also in the condition of having contacted the change-over member 874, it may replace with a slot 1016 and a through tube may be prepared. The path 1022 which carries out opening to the top face of the contact member 1014 is intersected, the through tube which penetrates the contact member 1014 is prepared, and air is made to flow out.

[0221] In previous explanation, a feeder 54 is arranged in order of wearing of the passive circuit elements 842 to a printed circuit board 408. Although 20 components adsorption nozzles 784 adsorb passive circuit elements 842, and the order prepared in the intermittent body of revolution 762 is made to be equipped with them, and there is little migration length of the intermittent body of revolution 762 at the time of wearing and he is trying to end at the time of adsorption For example, when the passive-circuit-elements feeders 14 and 16 are used for wearing of the passive circuit elements 842 to two or more kinds of printed circuit boards 408, the order of a list of a feeder 54 and the order of wearing of the passive circuit elements of a printed circuit board 408 cannot be made the same about the printed circuit board 408 of all classes. In this case, if intermittent rotation of the one every pitch of the intermittent body of revolution 762 tends to be carried out and it is going to make passive circuit elements 842 stick to 20 components adsorption nozzles 784 in order of wearing Although the passive circuit elements which should be made to stick to a degree among the feeders 54 located in a line with order immobilization are held, it is required to carry out sequential migration (migration of X shaft orientations) of the intermittent body of revolution 762 to a location, and it cannot avoid that the migration length of the intermittent body of revolution 762 for components adsorption becomes long. On the contrary, if it is made to make passive circuit elements 842 adsorb according to the order of a list of a feeder 54, carrying out intermittent rotation of the one every pitch of the intermittent body of revolution 762 The migration length of the intermittent body of revolution 762 serves as the shortest (although the migration length of the intermittent body of revolution 762 may become large in order to pass the feeder 54 which has held the unnecessary passive circuit elements 842). this -- being unavoidable -- the order of wearing to a printed circuit board 408 becomes less the optimal, and it cannot avoid that the migration (migration of X and Y shaft orientations) distance of the intermittent body of revolution 762 for wearing becomes long. Although it is also possible to choose either of these two modes fixed, and to carry it out, the mode in which both adsorption sequence and wearing sequence are suitably changed so that the sum of the migration length of the intermittent body of revolution 762 for components adsorption and the migration length of the intermittent body of revolution 762 for wearing may become min from a viewpoint of the improvement in

components wearing working capacity is suitable. It replaces with the cure with which it is made for the sum of this migration length to serve as min, or its cure, and if it permits that intermittent angle of rotation of the intermittent body of revolution 762 includes two or more pitches and inverse rotation, components wearing working capacity can be raised also by it. As mentioned above, although the components holder carried in intermittent body of revolution for easy-izing of explanation was made into one kind, since it considers as two or more kinds in fact, the class and array of a components holder are also further taken into consideration in that case, and it is efficiently desirable to set up adsorption sequence and wearing sequence so that passive circuit elements may be adsorbed and it may equip. For example, when two or more kinds of components holders are carried in intermittent body of revolution or two kinds of different components holders are formed by turns, make the forward direction or hard flow rotate intermittent body of revolution at a different include angle from the arrangement pitch of a components holder, two or more components holders are made to adsorb and equip with passive circuit elements in different sequence from the sequence carried in intermittent body of revolution, and it is made to perform adsorption of passive circuit elements, and wearing efficiently.

[0222] Furthermore, in said operation gestalt, two Maine conveyors may be formed three or more, although prepared. In that case, a carrying-in conveyor and a taking-out conveyor may be shifted to three or more shift positions which stand in a row on the Maine conveyor combining two or more hydrostatic pressure cylinders, respectively, or a servo motor may be shifted as a driving source. For example, while ****ing over the successive range of a carrying-in conveyor to conveyor susceptor and establishing a shaft, the nut of immobilization is screwed in a carrying-in conveyor, a **** shaft is rotated with a servo motor, and a carrying-in conveyor is alternatively moved to three or more shift positions.

[0223] If a carrying-in conveyor and a taking-out conveyor are moved using a servo motor, the location of arbitration can be made to be able to suspend a carrying-in conveyor and a taking-out conveyor, and the location of arbitration other than a shift position can also be stopped. For example, the equipment of the upstream of the passive-circuit-elements wearing system equipped with a carrying-in conveyor, a taking-out conveyor, and two Maine conveyors is the spreading system which has high viscous fluid coaters, such as a screen printer or an adhesives coater. Although the conveyor for handing over a circuit base material to a passive-circuit-elements wearing system is formed in 2 juxtaposition The arrangement pitch (distance of the direction where a conveyor is located in a line) of these conveyors may differ from the arrangement pitch of two Maine conveyors. A carrying-in conveyor It must move to the receipt location which stands in a row on two conveyors of upstream equipment, and receives a circuit base material in addition to the shift position connected with two Maine conveyors. In such a case, if a servo motor is moved for a carrying-in conveyor as a driving source, a carrying-in conveyor can be stopped in two receipt locations besides two shift positions, and a circuit base material can be made to receive by setup of a program. The downstream equipment formed in the downstream of a passive-circuit-elements wearing system for example, are the solder melting system which has the reflow furnace which is made to carry out melting of the solder and connects passive circuit elements to a circuit base material electrically, or Or it is the passive-circuit-elements wearing system which has equipment equipped with passive circuit elements with few wearing to one circuit base materials, such as a capacitor. The conveyor which receives a circuit base material from a taking-out conveyor, and conveys it is formed in 2 juxtaposition, and also when it differs from the arrangement pitch of the Maine conveyor whose arrangement pitch of these conveyors is two, it can respond by moving a servo motor for a taking-out conveyor as a driving source.

[0224] Moreover, when the bearing modification include angle of the 1st thru/or the 5th passive circuit elements is an include angle of 0**15 degrees, 90**15 degrees, 180**15 degrees, and 270**15 degrees out of range in previous explanation, Although an image pick-up is performed during migration to a printed circuit board and it enables it to start wearing to the printed circuit board of passive circuit elements quickly after migration after taking out all the passive circuit elements by which the wearing head was planned from a passive-circuit-elements feeder After picturizing about all the taken-out passive circuit elements, you may make it move to a printed circuit board. The number of the passive circuit elements with which it equips is 19 or less, and it is also the same as when only an image pick-up is performed after adsorption of all passive circuit elements.

[0225] Moreover, even if the components hold tape is used as the embossing type tape and the classes of passive circuit elements differed in said operation gestalt, although the location of the vertical direction (direction parallel to the migration direction of a components maintenance shaft) of the top face of passive circuit elements is fixed For example, when a components maintenance tape is a tape of the type instead of an embossing type with which the part in which the passive circuit elements of a tape-like hold container were held is supported and conveyed from a lower part, the location of the top face of passive circuit elements changes with height of passive circuit elements. In this case, as for the supply timing of the negative pressure at the time of a components adsorption shaft adsorbing passive circuit elements, and the rise-and-fall distance of a components adsorption shaft, it is desirable to adjust according to the height of passive circuit elements. For example, the same with changing the change timing to the negative pressure discharge condition of a pressure change-over valve into two kinds at the time of wearing, about the operation member which moves the change-over member of a pressure change-over valve to a negative pressure supply location, the Lord, the auxiliary actuator slack Lord, and an auxiliary air cylinder are prepared, and the operation location of an operation member is changed into two kinds. Moreover, the rise-and-fall distance of a rise-and-fall driving member is also changed into two kinds, and shortens rise-and-fall distance about passive circuit elements with large height. When switching to a negative pressure supply condition, or when switching to a negative pressure discharge condition, the change-over timing of a pressure change-over valve forms for example, not only two kinds but two or more auxiliary actuators of each other in a serial, and you may make it change them into three or more kinds.

[0226] Furthermore, while wearing of the passive circuit elements to a printed circuit board is performed, it may be made to perform the image pick-up of the reference mark of a printed circuit board just before the time of wearing termination, or wearing termination. Next, in the passive-circuit-elements wearing equipment formed in the same side as the Maine conveyor which supports the printed circuit board to which wearing of passive circuit elements is performed, a wearing program shows whether wearing of passive circuit elements is wearing of the last to the printed circuit board of one sheet for the passive-circuit-elements wearing equipment, and if it is the last, it will picturize while going passive circuit elements drawing to a

passive-circuit-elements feeder. If the image pick-up of a reference mark will be performed after wearing ending to the passive circuit elements of a printed circuit board, then wearing of passive circuit elements will be performed by the passive-circuit-elements wearing equipment of another side, if wearing of the passive circuit elements 842 to a printed circuit board is completed by wearing by the passive-circuit-elements wearing equipment, and wearing of the passive circuit elements 842 to a printed circuit board is completed, the image pick-up of a reference mark will be performed just before termination of wearing. A computer calculates the position error of the components wearing part of a printed circuit board based on image pick-up data among control, such as wearing of passive circuit elements, carrying in of a printed circuit board, and taking out, and stores it in memory. It is not indispensable that the position error of all components wearing parts is calculating before wearing initiation of the passive circuit elements to a printed circuit board, and you may calculate in parallel to wearing of passive circuit elements. If it is made such, there will be little storage capacity of a storage means to memorize a maintenance bearing error and a maintenance position error, and it will end.

[0227] Moreover, if there is a maintenance bearing error which exceeds **30 degrees to passive circuit elements in previous explanation, although he was trying not to be equipped, the passive circuit elements The judgment range of an adsorption error is further made large. For example, the range larger than said operation gestalt to **40 degrees, then passive circuit elements, Even if a maintenance bearing error may arise in **15 degrees (a maintenance bearing error in almost all cases) It falls within the range of **10 degrees, and wearing and an image pick-up can be performed in parallel, without [if it is not the case where a certain abnormalities occur, when not exceeding **15 degrees] the adsorption error having arisen. Furthermore, the bearing modification include angle at the time of performing wearing and an image pick-up of passive circuit elements in parallel can be set not only as within the limits of **15 degrees but as other include-angle range. For example, if the judgment range of an adsorption error is made into **40 degrees when the maintenance bearing error produced in passive circuit elements falls within the range which is **5 times in almost all cases, even if the bearing modification include angle of passive circuit elements is within the limits which is **30 degrees, wearing and an image pick-up can be performed in parallel.

[0228] Furthermore, although two or more amendments and bearing modification of a maintenance bearing error of a components holder are made using a common driver and a common driving source in said operation gestalt, a holder slewing gear is formed into one or the migration locus of the halt location of a components holder, and you may make it rotate a components holder. Prepare the engagement section which engages with the engagement member prepared in the holder slewing gear, an engagement member is made to engage with the engagement section of the components holder which reached the location in which an engagement member and engagement are possible, a components holder is rotated to the circumference of an axis, amendment of a maintenance bearing error is performed and a change of bearing is made.

[0229] Moreover, not only in under revolution of a components holder but in the condition of having stopped, amendment of the maintenance bearing error of a components holder is performed, and a change of bearing may be made.

[0230] Furthermore, although it descends and is raised while a components holder is moved before and behind a halt location in previous explanation (revolution), in either of halt location before and the back, migration (revolution), and descent and a rise may be made to be performed in parallel.

[0231] Moreover, even if migration of a components holder may be started in the condition [that the cam follower prepared in the components holder under a certain situation has inserted in notching even if it was the case where a components holder was stopped by the components receipt stowed position], damage is avoided when a cam follower passes notching.

[0232] Furthermore, although it is rotated to an evacuation location when it is in a downward location by incorrect actuation of a linear motor etc. at the time of the revolution at the time of a rise-and-fall driving member adsorbing and equipping with the passive circuit elements of a components adsorption shaft in said operation gestalt When a components adsorption shaft is revolved by hard flow and a rise-and-fall driving member is in a downward location by incorrect actuation etc., you may make it rotated to an evacuation location with a components adsorption shaft.

[0233] In previous explanation, moreover, the lowering speed of the migration member dropped by the linear motor at the time of wearing of passive circuit elements the time of being decelerated and passive circuit elements being contacted to a printed circuit board after acceleration, -- an impact, although it is contacted few, moderation is continued and it is dropped to downward end position After passive circuit elements contact a printed circuit board, it accelerates and you may make it a migration member reach to downward end position quickly.

[0234] Furthermore, in the operation gestalt shown in drawing 1 thru/or drawing 32, although width of face of a driver was made larger than the width of face of a driven gear, reverse is sufficient.

[0235] Moreover, the image pick-up equipment which picturizes the passive circuit elements held at the components holder is good also as what acquires the en face view of passive circuit elements.

[0236] Furthermore, although bearing of passive circuit elements is changed into different bearing from the time of a receipt while the maintenance bearing error of passive circuit elements is amended, when a components holder is rotated by the surroundings of an own axis in previous explanation, a circuit base material is equipped with passive circuit elements without changing bearing, and only amendment of a maintenance bearing error may be performed.

[0237] The description according to claim 3 can also be carried out apart from the 1st invention or the 2nd invention. Namely, while having on every two one both sides of the circuit base material supporting structure holding the circuit base material which should equip with passive circuit elements the components feeder which supplies passive circuit elements for a passive-circuit-elements wearing system ** The holder slewing gear which a position is made to suspend while holding two or more components holders and the components holder of ** these plurality which hold passive circuit elements, respectively and making it circle around a common fixed pivot line, ** The migration equipment for conveyance made to move a holder slewing gear to the location of the arbitration within the conveyance flat surface over a components feeder and the circuit base material supporting structure by having a migration member for conveyance holding the holder slewing gear, and moving the migration member for conveyance, ** Make the passive circuit elements supplied to the lifting device and ** components holder which it is held [holder] at the migration member for conveyance, and make it go up and down a components holder from a components feeder receive. While having two sets of wearing units containing the receipt wearing

control unit which makes the circuit base material held at the circuit base material supporting structure equip with passive circuit elements and making two components feeders and the circuit base material supporting structure stand it still during wearing at least The control unit which controls a holder slewing gear, the migration equipment for conveyance, a lifting device, and a receipt wearing control unit Make one side of a two-set wearing unit receive passive circuit elements from one side of two components feeders, and it is made to equip said circuit base material. The mutual wearing control means which makes another side of a wearing unit receive passive circuit elements from another side of a components feeder, and makes it equip a circuit base material, and makes the receipt of passive circuit elements and wearing perform to a these two sets wearing unit by turns to it shall be included. While a holder slewing gear and a lifting device make for example, aforementioned JP,6-196546,A stop each of two or more components holders in the location of arbitration like the holder slewing gear of a publication, and a lifting device in this passive-circuit-elements wearing system, adoption of the holder slewing gear of various modes, such as considering as the equipment to which make it go up and down a components holder, and the receipt of passive circuit elements and wearing are made to perform, and a lifting device is possible.

[0238] Furthermore, this invention can be carried out in the mode which changed the combination of the component of each of said operation gestalt. In addition, this invention can be carried out in the mode which performed various deformation and amelioration based on this contractor's knowledge, without deviating from a claim.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view showing the passive-circuit-elements wearing system which is 1 operation gestalt common to the 1st thru/or the 9th invention.
[Drawing 2] It is the front view showing the substrate conveyor which constitutes the above-mentioned passive-circuit-elements wearing system.
[Drawing 3] It is the side elevation showing the substrate conveyor and passive-circuit-elements wearing equipment which constitute the above-mentioned passive-circuit-elements wearing system.
[Drawing 4] It is the top view taking out and showing the above-mentioned substrate conveyor.
[Drawing 5] It is the side elevation showing the Maine conveyor which constitutes the above-mentioned substrate conveyor.
[Drawing 6] It is drawing showing the chain for adjusting each conveyance width of face of the carrying-in conveyor of the above-mentioned substrate conveyor, the Maine conveyor, and a taking-out conveyor, and arrangement of a sprocket.
[Drawing 7] It is the side elevation showing the passive-circuit-elements feeder which constitutes the above-mentioned passive-circuit-elements wearing system.
[Drawing 8] It is the side elevation (part cross section) showing the connection part of the above-mentioned passive-circuit-elements feeder and the pedestal of a passive-circuit-elements wearing system.
[Drawing 9] It is the side elevation showing the feeder which constitutes the above-mentioned passive-circuit-elements feeder.
[Drawing 10] It is the side elevation expanding and showing the part of delivery of the components maintenance tape of the above-mentioned feeder.
[Drawing 11] It is the front view (part cross section) showing the wearing head of the passive-circuit-elements wearing equipment which constitutes the above-mentioned passive-circuit-elements wearing system with an X-axis slide.
[Drawing 12] It is the transverse-plane sectional view showing the components adsorption shaft prepared in the above-mentioned wearing head.
[Drawing 13] It is the top view showing the part in which the passive-circuit-elements image pick-up equipment of the above-mentioned wearing head was formed.
[Drawing 14] It is the top view showing the above-mentioned wearing head.
[Drawing 15] It is the front view showing the above-mentioned wearing head with an X-axis slide.
[Drawing 16] It is drawing showing roughly the components adsorption shaft configuration prepared in the above-mentioned wearing head.
[Drawing 17] It is the top view showing the device section of the change-over valve control unit formed in the above-mentioned wearing head.
[Drawing 18] It is the front view showing the device section of the above-mentioned change-over valve control unit.
[Drawing 19] It is the side elevation showing the device section of the above-mentioned change-over valve control unit.
[Drawing 20] It is the front view showing the near part and near individual lifting device which switch the pressure change-over valve of the above-mentioned change-over valve control unit to a negative pressure supply condition.
[Drawing 21] It is the side elevation showing the near part and near individual lifting device which switch the pressure change-over valve of the above-mentioned change-over valve control unit to a negative pressure supply condition.
[Drawing 22] XXII-XXII in drawing 20 It is a sectional view.
[Drawing 23] It is the transverse-plane sectional view showing the operation member of the side which switches the pressure change-over valve of the above-mentioned change-over valve control unit to a negative pressure supply condition with the main air cylinder.
[Drawing 24] It is the block diagram showing the deep part of relation in this invention roughly among the control devices which control this passive-circuit-elements wearing system.
[Drawing 25] It is the timing diagram which shows delivery of the components maintenance tape in migration of XY robot of adsorption of the passive circuit elements of the above-mentioned passive-circuit-elements wearing system, an image pick-up, conveyance, and wearing which can set like 1 voice, rotation of intermittent body of revolution, rotation of a components adsorption shaft and rise and fall, and a feeder, and the actuation timing of passive-circuit-elements image pick-up equipment.
[Drawing 26] It is the graph showing a drive command and operating state of the main air cylinder of the change-over valve control unit at the time of adsorption of passive circuit elements, and wearing, and an auxiliary air cylinder.
[Drawing 27] It is the side elevation showing the operating state of the change-over valve control unit at the time of passive-circuit-elements adsorption.
[Drawing 28] It is the side elevation showing the operating state of the change-over valve control unit at the time of wearing of small passive circuit elements.
[Drawing 29] It is the side elevation showing the operating state of the change-over valve control unit at the time of wearing

of large passive circuit elements.
[Drawing 30] The number of adsorption of passive circuit elements is 20 pieces, and it is the graph showing adsorption shaft total angle of rotation at the time of the bearing error include angle in the mode in which an image pick-up and wearing of passive circuit elements are performed in parallel, an image recognition include angle, a bearing error amendment include angle, a bearing modification include angle, and wearing.
[Drawing 31] The number of adsorption of passive circuit elements is 20 pieces, and it is the graph showing adsorption shaft total angle of rotation at the time of the bearing error include angle in the mode in which the image pick-up of passive circuit elements is performed apart from wearing, an image recognition include angle, a bearing error amendment include angle, a bearing modification include angle, and wearing.
[Drawing 32] It is the graph showing adsorption shaft total angle of rotation at the time of a bearing error include angle in case the number of adsorption of passive circuit elements is 17 pieces, an image recognition include angle, a bearing error amendment include angle, a bearing modification include angle, and wearing.
[Drawing 33] It is the front view (part cross section) showing the wearing head of the passive-circuit-elements wearing system which is an operation gestalt common to the 1st thru/or the 5th, 8th, and 9th invention with an X-axis slide.
[Drawing 34] It is the left side view showing the wearing head shown in drawing 33 with an X-axis slide.
[Drawing 35] It is the top view showing the upper part of the intermittent body of revolution of the wearing head shown in drawing 33 .
[Drawing 36] It is the top view showing the lower part of the intermittent body of revolution of the wearing head shown in drawing 33 .
[Drawing 37] The components adsorption shaft of the wearing head shown in drawing 33 is the transverse-plane sectional view showing the condition of having been held by the adsorption shaft attachment component.
[Drawing 38] It is drawing showing roughly an example of arrangement of a components adsorption nozzle in case two kinds of components adsorption nozzles are carried in a wearing head.
[Drawing 39] It is drawing showing roughly another mode of arrangement of a components adsorption nozzle in case two kinds of components adsorption nozzles are carried in a wearing head.
[Drawing 40] It is drawing showing roughly arrangement of a components adsorption nozzle in case three kinds of components adsorption nozzles are carried in a wearing head.
[Drawing 41] It is the circuit diagram showing another mode of the part which controls supply of the air to a components adsorption nozzle in the change-over valve control unit which constitutes passive-circuit-elements wearing equipment.
[Description of Notations]
8: Passive-circuit-elements wearing system 12: Substrate conveyor 14 16: Passive-circuit-elements feeder 18 20: Passive-circuit-elements wearing equipment 400,402:Maine conveyor 404: Carrying-in conveyor 406: Taking-out conveyor 408: Printed circuit board 438:carrying-in conveyor shifter 508: Taking-out conveyor shifter
650,652:wearing head 662,664:XY robot 712:fixed cam 716: -- driver Servo motor for 724:bearing modification Servo motor for 742:revolution 762:intermittent body of revolution 776:components adsorption shaft 784:components adsorption nozzle 800: -- driven gear 804: -- cam follower 808:cam side 820:passive-circuit-elements image pick-up equipment 842: -- passive circuit elements 860:pressure change-over valve 880:individual lifting device 882:change-over valve control unit 890:migration member 892:rise-and-fall driving member 930:main air cylinder 952:operation member 974:main air cylinder 984:auxiliary air cylinder 1002:operation member 1030: -- link 1050: -- control device 1100:wearing head 1102:XY robot Servo motor for 1138:revolution 1150:drive bevel gear Servo motor for 1154:bearing amendment modification 1164:intermittent body of revolution 1182:driven bevel gear 1194:components adsorption nozzle 1260:pressure change-over valve 1290:passive-circuit-elements image pick-up equipment 1302: Individual lifting device
1304: Change-over valve control unit 1314: Migration member 1320: Main air cylinder 1322: Operation member 1330, 1332, 1340, 1342, 1344: Components adsorption nozzle 1400: Pressure change-over valve

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[Translation done.]

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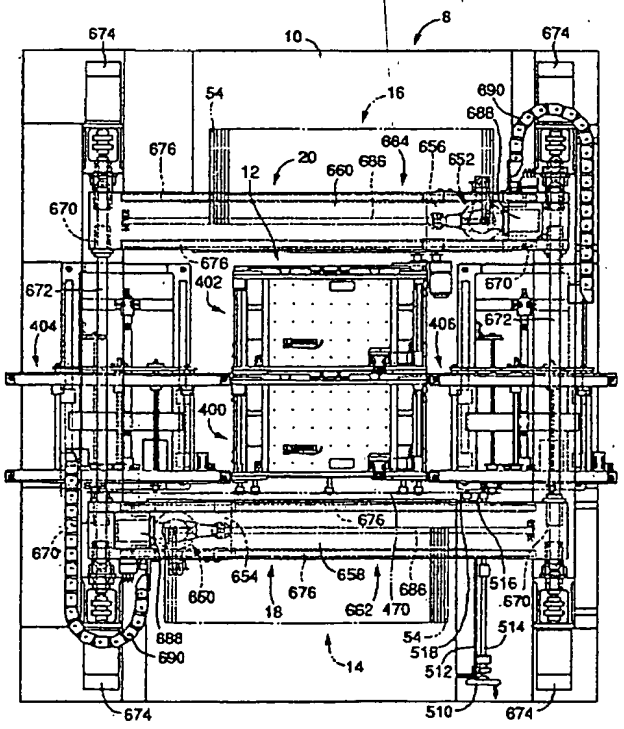
(54)【発明の名称】　回路部品装着システム

(57)【要約】

【課題】　複数の部品保持具が共通の軸線まわりに旋回し、部品供給装置と回路基材との間を移動して回路部品を受取り，装着し、装着能率の高いシステムを提供する。

【解決手段】　基台１０上に基板コンベヤ１２，２つずつの回路部品供給装置１４，１６，回路部品装着装置１８，２０を設ける。回路部品装着装置１８，２０は、複数の部品吸着軸を保持して間欠回転し、部品吸着装着位置に順次停止させる間欠回転体，部品吸着装着位置において部品吸着軸を昇降させ、回路部品を吸着，解放させる個別昇降装置等を有する装着ヘッド６５０，６５２、装着ヘッド６５０，６５２を水平面内の任意の位置へ移動させるＸＹロボット６６２，６６４を有する。間欠回転体の間欠回転，移動により複数の部品吸着軸が順次回路部品を取り出し、回路基材上へ移動し、間欠回転体の間欠回転，移動により保持した回路部品を順次回路基材に装着する。



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【特許請求の範囲】

【請求項１】　回路部品を供給する部品供給装置と、
前記回路部品を装着すべき回路基材を保持する回路基材保持装置と、
それぞれ回路部品を保持する複数の部品保持具と、
それら複数の部品保持具を保持して共通の旋回軸線のまわりに旋回させるとともに、その旋回軌跡上に予め定められた部品受取位置および部品装着位置に順次停止させる保持具旋回装置と、
その保持具旋回装置を保持する搬送用移動部材を備え、その搬送用移動部材を移動させることによって保持具旋回装置を前記部品供給装置と前記回路基材保持装置とに跨がる搬送平面内の任意の位置へ移動させる搬送用移動装置と、
前記搬送用移動部材に保持され、少なくとも部品受取位置および部品装着位置において部品保持具を昇降させる昇降装置と、
前記部品受取位置において前記部品保持具に前記部品供給装置から供給される回路部品を受け取らせ、部品装着位置において前記回路基材保持装置に保持された回路基材に回路部品を装着させる受取装着制御装置と、
前記保持具旋回装置，前記搬送用移動装置，前記昇降装置および前記受取装着制御装置を制御する制御装置とを含むことを特徴とする回路部品装着システム。

【請求項２】　前記保持具旋回装置が、前記複数の部品保持具を前記部品受取位置でも前記部品保持位置でもある部品受取装着位置に順次停止させるものであり、前記昇降装置が、少なくともその部品受取装着位置において各部品保持具を昇降させるものであることを特徴とする請求項１に記載の回路部品装着システム。

【請求項３】　前記部品供給装置を前記回路基材保持装置の両側に１つずつ２つ有するとともに、前記複数の部品保持具，前記保持具旋回装置，前記搬送用移動装置，前記昇降装置および前記受取装着制御装置を含む装着ユニットを２セット有し、前記２つの部品供給装置および前記回路基材保持装置が少なくとも装着作業中は静止させられるとともに、前記制御装置が、前記２セットの装着ユニットの一方に、前記２つの部品供給装置の一方から回路部品を受け取らせて前記回路基材に装着させ、装着ユニットの他方に、部品供給装置の他方から回路部品を受け取らせて前記回路基材に装着させ、かつ、それら２セットの装着ユニットに回路部品の受取りおよび装着を交互に行わせる交互装着制御手段を含むことを特徴とする請求項１または２に記載の回路部品装着システム。

【請求項４】　前記搬送用移動部材に、前記部品保持具に保持された回路部品に対向する状態で保持され、回路部品を撮像する撮像装置と、
その撮像装置により取得された回路部品の像に基づいて前記部品保持具による回路部品の保持位置誤差を取得し、その保持位置誤差に基づいて前記搬送用移動装置による前記保持具旋回装置の前記回路基材保持装置に対する位置決めを補正する位置決め補正手段とを含むことを特徴とする請求項１ないし３のいずれか１つに記載の回路部品装着システム。

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【請求項５】　前記部品保持具が前記保持具旋回装置により部品保持具の軸線まわりに回転可能に保持されるとともに、前記搬送用移動部材に部品保持具をその部品保持具の軸線のまわりに回転させる保持具回転装置が保持されており、かつ、当該回路基材装着システムが、前記搬送用移動部材に、前記部品保持具に保持された回路部品に対向する状態で保持され、回路部品を撮像する撮像装置と、その撮像装置により取得された回路部品の像に基づいて前記部品保持具による回路部品の保持方位誤差を取得し、その保持方位誤差に基づいて前記保持具回転装置を制御して保持方位誤差を補正する方位補正手段とを含むことを特徴とする請求項１ないし４のいずれか１つに記載の回路部品装着システム。

【請求項６】　さらに、
前記複数の部品保持具の旋回軌跡に沿って形成された高さの変化するカム面を備えたカム部材と、
前記複数の部品保持具の各々に対して各部品保持具と共に昇降可能に設けられ、前記カム面と係合することにより、部品保持具の旋回に伴って部品保持具を昇降させるカムフォロワとを含み、かつ、前記カム面の前記部品受取位置と前記部品装着位置との少なくとも一方に対応する部分より高い部分に対応する位置に前記撮像装置が配設されていることを特徴とする請求項４または５に記載の回路部品装着システム。

【請求項７】　さらに、
前記複数の部品保持具の旋回軌跡に沿って形成された高さの変化するカム面を備えたカム部材と、
前記複数の部品保持具の各々に対して各部品保持具と共に昇降可能に設けられ、前記カム面と係合することにより、部品保持具の旋回に伴って部品保持具を昇降させるカムフォロワとを含み、かつ、前記部品受取位置と前記部品装着位置との少なくとも一方が前記カム面の最も低い部分に対応する位置に設定されていることを特徴とする請求項１ないし５のいずれか１つに記載の回路部品装着システム。

【請求項８】　前記保持具旋回装置が、一定角度ずつ間欠回転し、その間欠回転角度の整数倍の角度間隔で前記複数の部品保持具を保持する間欠回転体を備え、前記撮像装置が間欠回転体の停止による部品保持具の複数の停止位置の一つに設けられてその停止位置が部品撮像位置とされ、前記部品受取位置および前記部品装着位置がその部品撮像位置とは異なる停止位置に設定されたことを特徴とする請求項４ないし７のいずれか１つに記載の回路部品装着システム。

【請求項９】　前記保持具回転装置が、前記複数の部品保持具を一斉に回転させるものであり、当該回路部品装

着システムが、それら部品保持具により受け取られることが予定されている回路部品のすべてが受け取られ、それら部品保持具により保持された回路部品の一部のみが前記撮像装置により撮像された状態で、前記搬送用移動装置に前記保持具旋回装置を前記回路基材上方へ移動させ、前記昇降装置に前記部品装着位置にある部品保持具に回路部品の装着を行わせるのと並行して前記撮像装置に回路部品の撮像を行わせる並行撮像制御手段を含むことを特徴とする請求項８に記載の回路部品装着システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電気・電子回路を構成する回路部品をプリント基板等の回路基材に装着するシステムの改良に関するものである。

【０００２】

【従来の技術】回路部品装着システムには、種々の態様のシステムがある。例えば、特公平２－５３９５４号公報に記載の回路部品装着システムは、複数の部品保持具と、それら複数の部品保持具を垂直な共通の旋回軸線のまわりに旋回させる保持具旋回装置と、回路部品を供給する部品供給装置と、回路基材を保持する回路基材保持装置とを備えている。保持具旋回装置は、垂直軸線まわりに回転可能に設けられ、複数の部品保持具を等角度間隔に保持する回転体と、その回転体を間欠回転させる間欠回転装置とを有している。回転体が間欠回転させられることにより、複数の部品保持具は複数の停止位置に順次停止させられ、それら複数の停止位置のうちの１つである部品受取位置において部品供給装置から回路部品を受け取り、別の停止位置である部品装着位置において回路部品を回路基材に装着する。部品供給装置は、移動テーブル上に搭載された複数の部品供給カートリッジを有する。複数の部品供給カートリッジは各部品供給部が一直線状に並ぶ状態で移動テーブルに搭載され、移動テーブルが移動テーブル移動装置によって上記一直線に平行な方向に移動させられることにより、複数の部品供給カートリッジの１つが部品供給位置に位置決めされる。また、回路基材保持装置は、回路基材を位置決め保持した状態で回路基材移動装置により水平面内の任意の位置に移動させられ、複数の部品装着箇所が順次、部品装着位置に位置決めされた部品保持具の下方に位置決めされて回路部品が装着される。この回路部品装着システムによれば、複数の部品保持具が短い時間間隔で部品受取位置および部品装着位置に到達して順次回路部品を受け取り、装着することができる。しかしながら、この回路部品装着システムにおいては、複数の部品供給カートリッジを支持する移動テーブルや、回路基材を位置決め保持する回路基材保持装置を移動させなければならないのであるが、これら移動テーブルや回路基材保持装置は大形であるため、広い移動スペースを確保しなければならず、システムが大形になることを避け得ない。また、部品供給装置の移動テーブルと回路基材保持装置とは、それぞれ移動しても互いに干渉しない位置に設けられるが、回路基材は、回路基材の全部の部品装着箇所が部品装着位置に位置決めされた部品保持具の下方の位置へ移動させられなければならないため、移動範囲が広く、部品供給装置と回路基材保持装置とが並ぶ方向において、回路基材の移動範囲の中間位置に設定された部品装着位置と、部品受取位置との距離が長くなる。そのため、回転体が大形になって間欠回転速度を大きくすることが困難である。

【０００３】それに対し、特開平６－１９６５４６号公報に記載の回路部品装着システムには、複数の部品保持具を保持して垂直軸線まわりに間欠回転させられる回転体が移動装置によって水平面内の任意の位置に移動させられ、部品保持具が、それぞれ位置を固定して設けられた部品供給装置から回路部品を取り出して回路基材に装着するように構成されている。複数の部品保持具は回転体に昇降可能に保持されており、回転体には、複数の部品保持具の各々について、部品保持具を昇降させ、下降位置であって回路部品の受取り，装着を行う作用位置と、上昇位置であって回路部品の受取り，装着を行わない非作用位置とに移動させる保持具選択装置が設けられている。これら保持具選択装置は、回転体に相対回転不能かつ軸方向に相対移動可能に嵌合された保持部材に設けられ、保持具選択装置のうちの１つが部品保持具を作用位置に位置させた状態で保持部材が下降させられることにより、選択された部品保持具が回路部品の受取り，装着を行う。この回路部品装着システムにおいて複数の部品保持具は、回転体の間欠回転により、複数の停止位置のうちの１つについて設定された部品受取位置に順次位置決めされて回路部品を受け取り、複数の部品保持具がそれぞれ回路部品を受け取った後、回路基材上へ移動させられて回路部品を回路基材に装着する。部品装着位置は１つに決まっておらず、部品保持具は旋回軌跡上の複数の停止位置のうちの任意の１つにおいて回路部品を回路基材に装着する。複数の部品保持具の各々について保持具選択装置が設けられているため、部品保持具はいずれの停止位置においても回路部品を装着可能なのである。この回路部品装着システムによれば、種々の効果が得られる。例えば、部品供給カートリッジが搭載されたカートリッジ支持テーブルや回路基材保持装置は移動しないため、大形のカートリッジ支持テーブルや回路基材保持装置の移動スペースを確保する必要がなく、システム全体をコンパクトに構成することができる。特に、供給する回路部品の種類が多く、部品供給カートリッジの数が多い場合や、回路基材が大きい場合、カートリッジ支持テーブルや回路基材保持装置が大形になるため、それらを移動させないことによる省スペース効果は大きい。また、部品供給装置と回路基材保持装置とを殆ど隙

間なく並べ設けることができ、その点においてもシステムをコンパクトに構成することができる。さらに、回転体は複数の部品保持具を保持可能な大きさを有すればよく、前記特公平２－５３９５４号公報に記載の回転体に比較して小さくすることができ、間欠回転速度を高くして１サイクルの作業時間（隣接する２個の部品保持具の一方による回路部品の保持終了あるいは装着終了から他方による回路部品の保持終了あるいは装着終了までに要する時間）を短縮することが可能である。作業時間の短縮効果は部品保持具の数が多いほど大きい。

【０００４】

【発明が解決しようとする課題】しかしながら、特開平６－１９６５４６号公報に記載の回路部品装着システムにおいては、部品装着位置が１つに決まっていないため、回路部品の装着に時間がかかる問題がある。回転体を、回路基材の相前後して回路部品が装着される２つの部品装着箇所間の距離に加えて、それら２つの部品装着箇所にそれぞれ装着する回路部品を保持する部品保持具間の距離も移動させなければならず、時間がかかるのである。また、部品受取位置と部品装着位置とが異なれば、受取り時と装着時とで回路部品の保持方位が異なるが、保持方位を補正するために回転体を回転させれば、それによっても移動距離が遠くなって装着に時間がかかることもある。保持方位の補正の必要がなくても、回転体を回転させれば、部品保持具の水平面内における位置を変えることができ、それにより部品保持具を部品装着箇所へ対応する位置へ近づけることもできるが、回路部品の方位が変わる上、移動装置の移動距離の算出も面倒である。請求項１に係る第１発明は、複数の部品保持具が共通の軸線まわりに旋回させられるとともに、部品供給装置と回路基材保持装置との間を移動させられて回路部品の受取り，装着を行うシステムであって、回路部品の装着にかかる時間が短くて済むシステムを提供することを課題として為されたものである。請求項２に係る第２発明は、第１発明に係る回路部品装着システムにおいて、部品受取位置と部品装着位置との昇降装置を兼用にすることを課題とする。請求項３に係る第３発明は、回路部品の回路基材への装着が２組の装着ユニットにより行われ、装着能率の高いシステムを提供することを課題とする。請求項４に係る第４発明は、回路部品の保持位置誤差が補正可能なシステムの提供を課題とする。請求項５に係る第５発明は、回路部品の保持方位誤差が補正可能なシステムの提供を課題とする。請求項６に係る第６発明は、撮像装置の設置が容易でコンパクトなシステムの提供を課題とする。請求項７に係る第７発明は、回路部品の受取りと装着との少なくとも一方を行う部品保持具以外の部品保持具を高い位置に位置させることができるシステムの提供を課題とする。請求項８に係る第８発明は、回路部品の撮像と受取りまたは保持とを並行して行い得るシステムの提供を課題とする。請求項９に係る第９発明は、撮像と回路部品の装着とが並行して行われ、装着能率の高いシステムの提供を課題とする。

【０００５】

【課題を解決するための手段，作用および発明の効果】第１発明に係る回路部品装着システムは、上記の課題を解決するために、（Ａ）回路部品を供給する部品供給装置と、（Ｂ）回路部品を装着すべき回路基材を保持する回路基材保持装置と、（Ｃ）それぞれ回路部品を保持する複数の部品保持具と、（Ｄ）それら複数の部品保持具を保持して共通の旋回軸線のまわりに旋回させるとともに、その旋回軌跡上に予め定められた部品受取位置および部品装着位置に順次停止させる保持具旋回装置と、（Ｅ）その保持具旋回装置を保持する搬送用移動部材を備え、その搬送用移動部材を移動させることによって保持具旋回装置を部品供給装置と回路基材保持装置とに跨がる搬送平面内の任意の位置へ移動させる搬送用移動装置と、（Ｆ）搬送用移動部材に保持され、少なくとも部品受取位置および部品装着位置において部品保持具を昇降させる昇降装置と、（Ｇ）部品受取位置において部品保持具に部品供給装置から供給される回路部品を受け取らせ、部品装着位置において回路基材保持装置に保持された回路基材に回路部品を装着させる受取装着制御装置と、（Ｈ）保持具旋回装置，搬送用移動装置，昇降装置および受取装着制御装置を制御する制御装置とを含むように構成される。

【０００６】この回路部品装着システムにおいては、保持具旋回装置による部品保持具の旋回と、搬送用移動装置による保持具旋回装置の移動とによって、複数の部品保持具が順次部品受取位置へ移動させられるとともに、部品供給装置の部品供給部に対応する位置に位置決めされて回路部品を受け取る。部品受取位置において部品保持具は昇降装置により昇降させられ、部品供給装置から回路部品を取り出す。予定の回路部品をすべて受け取った後、部品旋回装置が搬送用移動装置によって回路基材上へ移動させられ、回路部品の受取り時と同様に、複数の部品保持具が順次部品装着位置へ移動させられるとともに、回路基材の部品装着箇所に対応する位置に位置決めされ、昇降装置により昇降させられて回路部品が回路基材に装着される。保持具旋回装置が保持する全部の回路部品が回路基材に装着された後、保持具旋回装置は搬送用移動装置により部品供給装置へ移動させられて再び回路部品を受け取る。このように本発明に係る回路部品装着システムによれば、前記特開平６－１９６５４６号公報に記載のシステムにおけると同様に、複数の部品保持具が移動させられて回路部品を部品供給装置から取り出し、回路基材に装着することによる効果、すなわちシステムの小形化等の効果が得られ、しかも、部品保持具が旋回軌跡上の決まった位置において回路部品を部品供給装置から受け取り、回路基材に装着するため、装着時における保持具旋回装置の移動距離は、従来のように、

相前後して回路部品を装着する２つの部品保持具間の距離は含まず、２つの部品装着箇所間の距離のみであって短く、迅速に回路部品を装着することができる。なお、昇降装置が「少なくとも部品受取位置および部品装着位置において部品保持具を昇降させる」とは、本発明には、発明の実施の形態において説明するように、部品保持具が部品受取位置や部品装着位置に到達して停止した後に下降させられる態様のみならず、部品保持具の下降と旋回とが並行して行われ、部品保持具が部品受取位置や部品装着位置に到達する前に下降を開始させられる態様や、部品受取位置や部品装着位置とは全く別の停止位置で部品保持具を下降させる態様が含まれることを意味する。昇降装置は、部品保持具を直接昇降させるものとしてもよく、部品保持具を保持する部材を昇降させるものとしてもよい。また、「搬送平面」は、水平面に限らず、傾斜した平面でもよい。搬送平面は、ＸＹ座標や極座標等により規定され、搬送用移動装置は、ＸＹロボットでもよく、回動アームを備え、極座標により移動位置が規定されるロボットでもよく、さらに、サーフェスステッピングモータでもよい等、種々の態様の装置が採用可能である。サーフェスステッピングモータは、例えば、特開平７－４５９９５号公報に記載されているように、平面状のステータを有する。ステータは磁路を形成し、例えば、磁性材料により作られるとともに多数の突極を有し、可動子の移動範囲全体に設けられる。可動子は、それぞれ、ヨークに磁界を作るコイルが巻き付けられた複数の電磁素子を有し、これら複数の電磁素子が選択的に励磁されることにより、可動子がステータに平行な平面内の任意の位置へ移動させられる。したがって、搬送用移動部材を可動子に取り付ければ（可動子そのものを搬送用移動部材としてもよい）、保持具旋回装置を搬送平面内の任意の位置へ移動させることができる。サーフェスステッピングモータを用いれば、ステータが搬送用移動部材の移動を案内する機能を果たし、ステータのあるところであればどこへでも移動することができる。特に、後述するように、保持具旋回装置が複数設けられる場合、各保持具旋回装置を保持する搬送用移動部材の案内装置同士の干渉がなく、複数の保持具旋回装置の移動の自由度が高くなり、部品供給装置からの回路部品の取出や回路基材への装着の自由度が高くなり、回路部品を効率良く装着することが可能となる。２つの保持具旋回装置に同時期に１つの回路基材に回路部品を装着させることも可能となるのであり、必要に応じて保持具旋回装置の数を３つ以上とすることもできる。部品保持具は、後述するように、部品吸着具でもよく、複数の把持部材により回路部品を把持する部品把持具でもよい。複数の把持部材は、把持部材開閉装置により、互いに対称に開閉させられて回路部品を把持、解放する。昇降装置は、部品保持具を直接昇降させるものでもよく、あるいは部品保持具を保持する部材を昇降させるものでもよい。

【０００７】第２発明においては、第１発明に係る回路部品装着システムにおいて、保持具旋回装置が、複数の部品保持具を部品受取位置でも部品保持位置でもある部品受取装着位置に順次停止させるものとされ、昇降装置が、少なくともその部品受取装着位置において各部品保持具を昇降させるものとされる。部品受取位置と部品保持位置とを共通にすれば、昇降装置の数を減らすことができ、装置コストの低減が可能となる。また、部品受取り時と部品装着時とにおいて回路部品の方位が変わらないため、従来のように部品受取位置と部品装着位置とが異なることによる方位の補正の必要がなく、容易にかつ迅速に回路部品を回路基材に装着することができる。

【０００８】第３発明においては、第１または第２発明に係る回路部品装着システムが、部品供給装置を回路基材保持装置の両側に１つずつ２つ有するとともに、複数の部品保持具，保持具旋回装置，搬送用移動装置，昇降装置および受取装着制御装置を含む装着ユニットを２セット有し、２つの部品供給装置および回路基材保持装置が少なくとも装着作業中は静止させられるとともに、制御装置が、２セットの装着ユニットの一方に、２つの部品供給装置の一方から回路部品を受け取らせて回路基材に装着させ、装着ユニットの他方に、部品供給装置の他方から回路部品を受け取らせて同じ回路基材に装着させ、かつ、それら２セットの装着ユニットに回路部品の受取りおよび装着を交互に行わせる交互装着制御手段を含むものとされる。本発明に係る回路部品装着システムにおいては、２セットの装着ユニットのうちの一方が回路部品を回路基材に装着している間に、他方が部品供給装置から回路部品を受け取り、一方による回路部品の装着終了後、直ちに他方が回路部品の装着を開始する。装着ユニットが１セットのみ設けられているのであれば、部品保持具が部品供給装置から回路部品を受け取っている間は装着が行われず、無駄であるのに対し、装着が殆ど休みなく行われ、回路部品を能率良く装着することができる。また、部品供給装置は、回路基材保持装置の両側に１つずつ設けられるため、２つの保持具旋回装置の干渉を避けつつ一方の保持具旋回装置を部品供給装置へ移動させ、他方の保持具旋回装置を回路基材へ移動させることが容易であり、搬送用移動装置の設計や装着プログラムの作成が容易なシステムが得られる。２つの部品供給装置の各々が供給する回路部品の種類は同じでもよく、異なっていてもよい。いずれにしても、２つの装着ユニットは共同して１つの回路基材に回路部品を装着する。供給する回路部品の種類が同じであれば、２つの装着ユニットのいずれから装着を開始するかが必ずしも問われない利点がある。また、２つの装着ユニットの各部品供給装置が保持する回路部品の種類が異なれば、回路部品の種類が多くても、２つの部品供給装置に分けて持たせるとともに、回路基材の両側に配設することによ

り、保持する回路部品の種類が多い大形の部品供給装置を回路基材の一方の側に設ける場合に比較してシステムをコンパクトにまとめて設けることができる。なお付言すれば、部品供給装置を２つ設けることと、装着ユニットを２組設けることとは、常に一緒に採用されなければならないわけではなく、第１または第２発明の実施態様としては、いずれか一方のみが２つまたは２組設けられた回路部品装着システムもあり得る。

【０００９】第４発明は、第１ないし第３発明のいずれか１つに係る回路部品装着システムにおいて、（ａ）搬送用移動部材に、部品保持具に保持された回路部品に対向する状態で保持され、回路部品を撮像する撮像装置と、（ｂ）その撮像装置により取得された回路部品の像に基づいて部品保持具による回路部品の保持位置誤差を取得し、その保持位置誤差に基づいて搬送用移動装置による保持具旋回装置の回路基材保持装置に対する位置決めを補正する位置決め補正手段とを設けたことを要旨とする。このシステムにおいては、回路部品が撮像されるとともに、保持位置誤差が補正され、回路部品が回路基材の部品装着箇所に精度良く装着される。撮像装置が搬送用移動部材に保持されて保持具旋回装置と共に移動するため、回路部品の受取りと並行して撮像を行うことが可能であり、撮像結果に基づく保持位置誤差の算出に必要な時間を確保しつつ部品装着の高速化を図ることができる。撮像は、回路部品が停止している状態で行ってもよく、移動している状態で行ってもよい。例えば、撮像装置を、ストロボ付高速度カメラあるいはラインセンサを含むものとすれば、回路部品が移動している状態でも撮像することが可能である。ストロボ付高速度カメラは、回路部品が通過するとき、回路部品に強い光を照射して撮像する。回路部品は移動しているが、シャッタ速度を極めて大きくするか、照明時間を極く短くすることにより、回路部品をあたかも静止しているかのように撮像することができる。ラインセンサは、一直線状に並べられた多数の撮像素子を有し、部品保持具の旋回軸線を中心とする円の半径方向に長く延びる姿勢で設けられ、一定時間毎に回路部品を撮像する。撮像は、部品保持具が等速で移動する状態で行われ、回路部品の像は、その移動方向において１ライン分ずつ分けて撮像され、回路部品がラインセンサを通過し終わったとき、回路部品の全体像のデータが得られる。ラインセンサによる撮像の繰返しと部品保持具の移動とによって回路部品の２次元像が得られるのである。ただし、部品保持具は回動しており、回路部品のラインセンサに対する角度が撮像毎に異なるため、この角度の変化を考慮して２次元像を構成することが必要である。

【００１０】第５発明は、第１ないし第４発明のいずれか１つに係る回路部品装着システムにおいて、部品保持具が保持具旋回装置により部品保持具の軸線まわりに回転可能に保持されるとともに、搬送用移動部材に部品保

持具をその部品保持具の軸線のまわりに回転させる保持具回転装置が保持されており、かつ、当該回路基材装着システムが、搬送用移動部材に、部品保持具に保持された回路部品に対向する状態で保持され、回路部品を撮像する撮像装置と、その撮像装置により取得された回路部品の像に基づいて部品保持具による回路部品の保持方位誤差を取得し、その保持方位誤差に基づいて保持具回転装置を制御して保持方位誤差を補正する方位補正手段とを含むものとされる。このシステムにおいては、部品保持具による回路部品の保持方位誤差が補正され、回路部品は正確な方位で回路基材に装着される。保持具回転装置は、発明の実施の形態において説明するように、複数の部品保持具を一斉に回転させるものとしてもよく、あるいは個々に回転させるものとしてもよい。保持具回転装置は、最終的に搬送用移動部材に保持され、それと共に移動可能であればよく、例えば、保持具旋回装置に保持されていてもよい。また、保持具回転装置により、保持方位誤差を補正するのみならず、回路部品の保持方位を予め設定された方位に変更してもよい。

【００１１】第６発明は、第４または第５発明に係る回路部品装着システムにおいて、さらに、（ア）複数の部品保持具の旋回軌跡に沿って形成された高さの変化するカム面を備えたカム部材と、（イ）複数の部品保持具の各々に対して各部品保持具と共に昇降可能に設けられ、カム面と係合することにより、部品保持具の旋回に伴って部品保持具を昇降させるカムフォロワとを設け、かつ、カム面の部品受取位置と部品装着位置との少なくとも一方に対応する部分より高い部分に対応する位置に撮像装置を配設したことを要旨とするものである。このシステムにおいては、複数の部品保持具は保持具旋回装置によって旋回させられるとともに、カムおよびカムフォロワにより昇降させられ、それにより形成された隙間に撮像装置が配設される。換言すれば、撮像装置と部品保持具およびそれに保持された回路部品との干渉、ならびに撮像装置と部品供給装置および回路基材との干渉を回避しつつ、部品受取，装着時の昇降距離を小さくし得る。カム部材およびカムフォロワとしては、簡易化，小形化の観点からは、発明の実施の形態において説明する端面カムおよび球状カムフォロワが好適であるが、溝カム，突条カムおよびローラ等としてもよい。なお、通常、「高さ」とは垂直方向における物の位置を表し、複数の部品保持具の旋回軸線が垂直な場合、カム面の高さの変化により複数の部品保持具の高さが変化すると言うことができるが、旋回軸線は、後述するように搬送平面に対して傾斜させられることもある。この場合、カム部材のカム面は、旋回軸線を中心とする円錐面上においてその円錐面の頂点からの距離が変化するものとされ、部品保持具はカム面に沿って円錐面の各母線に平行な方向に移動させられることとなるが、この部品保持具の位置の変化も高さの変化であると考えることとする。

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【００１２】第７発明は、第１ないし第６発明のいずれか１つに係る回路部品装着システムにさらに、（α）複数の部品保持具の旋回軌跡に沿って形成された高さの変化するカム面を備えたカム部材と、（β）複数の部品保持具の各々に対して各部品保持具と共に昇降可能に設けられ、カム面と係合することにより、部品保持具の旋回に伴って部品保持具を昇降させるカムフォロワとを設け、かつ、部品受取位置と部品装着位置との少なくとも一方をカム面の最も低い部分に対応する位置に設定したことを要旨とする。このシステムにおいて部品保持具は保持具旋回装置によって旋回させられるとともに、カム部材およびカムフォロワにより昇降させられ、部品受取位置と部品装着位置との少なくとも一方における部品保持具の昇降距離を小さくし、受取りと装着との少なくとも一方に要する時間を短くしながら、他の部品保持具を高い位置に保ち得る。もし、すべての部品保持具が同じ高さにあれば、それらすべての部品保持具が、部品供給装置，回路基材保持装置および回路基材に既に装着された回路部品等の、部品保持具と対向する可能性のある部分のうちで最も高い部分より高くなるようにする必要があり、部品受取位置と部品装着位置との少なくとも一方において、部品供給装置の部品供給部や回路基材の部品装着箇所に十分近づけることができず、部品受取りや装着のための昇降距離が大きくなってしまう。それに対し、本発明によれば、部品受取位置と部品装着位置との少なくとも一方およびその近傍にある部品保持具以外は高い位置に保ち得るため、他の部品保持具が部品供給装置や回路基材保持装置と干渉することを回避しつつ、部品受取位置と部品装着位置との少なくとも一方の部品保持具を部品供給部や部品装着箇所に十分近づけることができるのである。

【００１３】第８発明は、第４ないし第７発明のいずれか１つに係る回路部品装着システムの保持具旋回装置を、一定角度ずつ間欠回転し、その間欠回転角度の整数倍の角度間隔で複数の部品保持具を保持する間欠回転体を備えたものとし、撮像装置を間欠回転体の停止による部品保持具の複数の停止位置の一つに設けてその停止位置を部品撮像位置とし、部品受取位置および部品装着位置をその部品撮像位置とは異なる停止位置に設定したことを要旨とする。このシステムにおいては、停止状態の回路部品を撮像装置で撮像し、しかもその撮像を他の回路部品の受取りまたは装着と並行して行うことが可能であり、装着能率を向上させることができる。部品保持具の配設角度間隔は一種類に限らず、複数種類に変えることも可能である。保持具旋回装置は、発明の実施の形態において説明するように、間欠回転体を回転させるために専用の駆動源（例えば、サーボモータ等の電動モータ）を有するものとしてもよいが、他の装置（例えば昇降装置）と駆動源を共用し、カム，カムフォロワを含む運動変換装置等によって伝達される駆動源の駆動力により間欠回転体を回転させるものとしてもよい。駆動源の駆動力は、別のカム，カムフォロワ等を含む運動変換装置により昇降装置の昇降運動に変換される。専用の駆動源を設ければ、間欠回転体を任意の角度回転させることができ、例えば、１番目に回路部品を装着する部品保持具を逆方向に旋回させて最短の回転角度で部品受取位置や部品装着位置に位置させることなどが可能となり、回路部品を能率良く装着することができる。また、間欠回転体に設けられる部品保持具の種類が変わり、部品保持具の配設間隔が変わって間欠回転角度が変わっても容易に対応することができる。また、発明の実施の形態において説明するように、複数の部品保持具を間欠回転体の回転軸線を中心とする一円周上において、回転軸線に平行に保持させれば、回転軸線に対して放射状に保持させる場合に比較して間欠回転体の径を大きくすることなく、部品保持具の保持数を多くすることができ、間欠回転角度が小さく、間欠回転に要する時間が短く、装着能率を向上させることができる。

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【００１４】第９発明は、第８発明に係る回路部品装着システムにおいて、保持具回転装置を、複数の部品保持具を一斉に回転させるものとするとともに、当該回路部品装着システムを、それら部品保持具により受け取られることが予定されている回路部品のすべてが受け取られ、それら部品保持具により保持された回路部品の一部のみが撮像装置により撮像された状態で、搬送用移動装置に保持具旋回装置を回路基材上方へ移動させ、昇降装置に部品装着位置にある部品保持具に回路部品の装着を行わせるのと並行して撮像装置に回路部品の撮像を行わせる並行撮像制御手段を含むものとしたことを要旨とする。間欠回転体の間欠回転につれて回路部品の受取りと撮像が並行して行われる場合、部品受取位置と撮像位置とは離れているため、部品保持具により受け取られることが予定されている回路部品のすべてが受け取られたとき、部品受取位置と撮像位置との間に位置する回路部品については未だ撮像が行われていない。これらの回路部品についても撮像を行った後に、回路部品の装着を開始することも可能であるが、撮像を装着と並行して行わせれば、並行撮像が行われる分だけ、全回路部品の装着に要する時間を短縮し得る。複数の部品保持具のすべてに回路部品が保持され、その直後に水平移動装置により保持具旋回装置が回路基材上方へ移動させられる場合が最も効果的である。

【００１５】

【発明の補足説明】本発明は上記各請求項に記載の態様の外に、下記の態様でも実施可能である。実施の態様は、便宜上、請求項と同じ形式の実施態様項として記載する。ただし、複数の請求項または実施態様項に従属する実施態様項にさらに従属する実施態様項は、それら複数の請求項または実施態様項のすべてについて読み得るとは限らず、論理的に矛盾を生じない項のみについて読

まれるべきものとする。

（１）前記部品保持具が、軸部と、その軸部の下端に回路部品を保持する部品保持部を備えている請求項１ないし９のいずれか１つに記載の回路部品装着システム。

（２）前記保持具旋回装置が、前記旋回軸線のまわりに互いに独立に回動可能な複数の回動部材と、それら複数の回動部材に、それぞれ前記旋回軸線を一周するとともにその一周の間に１回以上の停止を含み、かつ互いに一定時間差を有する回動運動を付与する回動運動付与装置とを備え、それら回動部材の各々に前記旋回軸線から等距離の位置に形成された保持部の各々に、前記複数の部品保持具の各軸部がそれぞれ軸方向に移動可能に保持された実施態様項１に記載の回路部品装着システム。部品保持具を保持し、回動部材に部品保持具の軸線に平行な方向に移動可能に保持された移動部材を設けることも可能である。この場合には、移動部材の移動により部品保持具が自身の軸線に平行な方向に移動させられることとなる。保持部を回動部材に形成した保持穴とし、部品保持具を保持穴に回転可能に嵌合すれば、部品保持具をその軸線のまわりに回転させ、回路部品の保持方位を変更し、保持方位誤差を補正することができる。このようにそれぞれ部品保持具を保持して互いに独立に回動する複数の回動部材を備えた保持具旋回装置は、本出願人による特願平７－３４２４３０号の明細書に記載されている。回動運動付与装置は、例えば、複数の回動部材の各々に対してそれぞれ設けられたカムフォロワと、それらカムフォロワに順次係合してカムフォロワを移動させることにより各回動部材を回動させる少なくとも１個の回動運動付与カムとを含むものとされる。望ましくは、回動運動付与カムが、前記旋回軸線を中心とする円弧を、その円弧に対して前記旋回軸線とは反対側に位置するとともにその旋回軸線と直角に立体交差する軸線のまわりに回転させた場合その円弧が描く軌跡を外周面とする鼓形カムとされ、鼓形カムが、複数の部品保持具の旋回軸線を対称軸として軸対称に複数個配設され、それら複数の鼓形カムの全軸線を含む一平面とそれら複数の鼓形カムの各外周面との交線の集合が、実質的に連続した一円周を描くものとされる。

（３）前記保持具旋回装置が、前記旋回軸線のまわりに回転させられるとともに、旋回軸線から等距離の位置に複数個設けられた保持部の各々に前記複数の部品保持具の各軸部が軸方向に移動可能に保持された回転体を備えた実施態様項１に記載の回路部品装着システム。この態様においても、部品保持具を保持し、回転体に部品保持具の軸線に平行な方向に移動可能に保持された移動部材を設けることが可能である。この場合には、移動部材の移動により部品保持具が自身の軸線に平行な方向に移動させられることとなる。保持部を保持穴とし、部品保持具を保持穴に回転可能に嵌合すれば、部品保持具をその軸線のまわりに回転させ、回路部品の保持方位を変更し、誤差を補正することができる。

（４）前記旋回軸線が前記搬送平面と直交し、前記保持部が旋回軸線に平行に形成された実施態様項２または３に記載の回路部品搬送装置。

（５）前記複数の保持部が、前記回転体の前記旋回軸線を中心線とする円錐面の複数の母線の各々を中心線として形成されており、前記旋回軸線が、前記搬送平面に対する垂線に対して、前記円錐面の一母線が前記搬送平面と直交する状態となる角度だけ傾斜させられた実施態様項２または３に記載の回路部品搬送装置。態様４または５のシステムにおいて、搬送平面が傾斜面であれば、部品保持具も傾斜した軸線に沿って昇降させられる。回路基材が傾斜して保持され、部品供給装置が傾斜して設けられていれば、部品保持具を傾斜した軸線に沿って昇降させることにより、部品供給装置や回路基材に対して直角に接近，離間させることができ、回路部品の受取り、装着をスムーズに行うことができる。態様５のシステムにおいては、回転体の回転に伴って部品保持具の高さ（搬送平面との距離）を変えることができ、上下方向の隙間に撮像装置を配設し得る等の効果が得られる。また、カム部材やカムフォロワを設けなくても部品保持具の高さを変えることができ、部品点数が少なくて済み、移動質量が小さく、搬送用移動装置による保持具旋回装置の移動速度を高くして装着能率を向上させることができる。

（６）前記カム部材が、前記部品保持具の旋回軌跡の上方に配設されるとともに、カム部材の下面が高さの変化するカム面とされており、前記カムフォロワが前記軸部の上端にあらゆる方向に回転可能に保持され、前記カム面上を転動する球状のカムフォロワであり、かつ、前記部品保持具を前記カム部材に向かって付勢する付勢手段を含む請求項６ないし９，実施態様項１ないし５のいずれか１つに記載の回路部品装着システム。球状のカムフォロワはカム面に沿って移動するとき、どの方向を向いていてもよいため、部品保持具の軸部の上端にあらゆる方向に回転可能に保持させればよく、カムフォロワとしてローラを用いる装置のように、ローラを回転可能に支持する支持軸および部品保持具を保持する部材に対して相対回転不能であってローラを支持する支持部材を設ける必要がなく、保持具旋回装置の構成を簡易化することができる。その結果、部品点数の減少によるコスト低減，部品保持具を保持する部材と共に移動する部材の質量の減少による移動速度高速化等の効果が得られる。また、球状のカムフォロワはカム面上を転動するため、部品保持具の軸部の上端部に外面が半球面状を成すカムフォロワを一体的に設け、カム面に沿って移動させる場合に比較して摺動抵抗が少なくて済み、摩耗が少なく、寿命の長い装置が得られる。球状のカムフォロワは、どの方向にも向くことができ、部品保持具が自身の軸線のまわりに回転させられる場合、部品保持具の回転を許容す

る。部品保持具を回転させる場合、カムフォロワがローラのように回転軸線の方向を１つに決めなければならないものであれば、部品保持具にカムフォロワを保持させることができず、部品保持具とは別にカムフォロワを、その回転軸線の方向が１つに決められた状態で保持する部材を設けなければならないのに対し、部品保持具に直接カムフォロワを保持させることができ、旋回軌跡中において高さを変えることができ、部品保持具を回転させ得るとともに、構成が簡易で安価な保持具旋回装置が得られる。

（７）前記カム部材の前記部品受取装着位置に対応する部分に切欠が形成され、前記昇降装置が、その切欠に昇降可能に嵌合された昇降駆動部材と、その昇降駆動部材を、それの下面が前記カム面と連続する上昇位置と、下面がカム面より下方に位置する下降位置との間で昇降させる昇降駆動装置とを含む実施態様項６に記載の回路部品装着システム。部品保持具の昇降時以外は、昇降駆動部材は上昇位置にあり、カムフォロワはカム面に沿って移動し、昇降駆動部材の下面に係合する。この状態で昇降駆動部材が下降させられれば、部品保持具が下降させられ、昇降駆動部材が上昇させられれば、部品保持具は付勢手段の付勢力により昇降駆動部材に追従して上昇させられ、カムフォロワがカム面に係合する位置へ復帰する。保持旋回装置が部品保持具をそれの旋回軌跡上の予め定められた位置に停止させるものであり、昇降駆動部材がその停止位置に設けられる場合に、昇降駆動装置は、部品保持具が停止位置に停止させられてから昇降駆動部材を下降させるものとしてもよく、停止位置の前と後ろとの少なくとも一方において、カムフォロワが昇降駆動部材に係合した状態で昇降駆動部材を下降させるものとしてもよい。後者の場合は、部品保持具の旋回と回路部品の受取りおよび装着のための下降，上昇の少なくとも一方とが並行させられることとなり、部品保持具の昇降を伴って行われる作業の時間を短縮することができる。

（８）前記昇降駆動部材が、前記昇降装置に、常には前記切欠に嵌合可能な作用位置にあるが、前記下降位置において前記部品保持具の旋回方向に設定値以上の力が加えられた場合には部品保持具の移動を妨げない退避位置へ退避可能に保持されている実施態様項７に記載の回路部品装着システム。

（９）前記昇降駆動部材が、前記昇降装置に、前記部品保持具の旋回軌跡から側方へ外れた位置において垂直軸線まわりに回動可能に保持されており、その回動により前記退避位置へ退避する実施態様項８に記載の回路部品装着システム。昇降駆動部材は、厳密には、昇降駆動装置の出力部材に垂直軸線まわりに回動可能に保持され、その垂直軸線から外れた部分において部品保持具に係合し、退避位置へ回動させられる。昇降駆動部材を平行移動により退避位置へ移動するものとすることも可能であるが、回動による方が昇降駆動装置による昇降駆動部材の保持構造を簡易にすることができ、安価に目的を達成することができる。

（１０）前記昇降装置が、前記昇降駆動部材を前記作用位置に向かって付勢する付勢手段と、その付勢手段の付勢力に抗して作用位置に保つストッパとを含む実施態様項７ないし９のいずれか１つに記載の回路部品装着システム。

（１１）前記ストッパが、前記昇降駆動部材を昇降可能に保持する保持部材に、位置調節可能に取り付けられた調節可能ストッパ部材を含む実施態様項１０に記載の回路部品装着システム。

（１２）前記カム部材の前記切欠が、前記球状のカムフォロワが通過可能な深さで形成されている実施態様項７ないし１１のいずれか１つに記載の回路部品装着システム。

（１３）さらに、前記昇降駆動部材の前記退避位置に向かう移動を検知して検知信号を発する移動検知装置と、その移動検知装置の検知信号に応じて前記保持具旋回装置の旋回を停止させる旋回停止手段とを含む実施態様項８ないし１２のいずれか１つに記載の回路部品装着システム。昇降駆動部材の退避位置に向かう移動を検知する代わりに、昇降駆動部材の昇降時以外の時期における下降位置への移動を検知することにより、部品保持具の旋回を停止させるようにしてもよい。

（１４）前記部品保持具が、負圧により前記回路部品を吸着して保持する部品吸着具である請求項１ないし９，実施態様項１ないし１３のいずれか１つに記載の回路部品装着システム。回路部品を負圧により吸着して保持すれば、回路部品を損傷する恐れなく保持することができる。また、部品保持具の構成が単純となるとともに、回路部品の保持，解放の制御が簡単となり、さらに部品保持具に保持された回路部品の撮像も容易となる。

（１５）さらに、前記部品吸着具内の圧力を制御することにより部品吸着具に回路部品の吸着，解放を行わせる圧力制御装置を含む実施態様項１４に記載の回路部品搬送装置。

（１６）前記圧力制御装置が、前記保持具旋回装置に保持され、前記部品吸着具内の圧力を切り換える切換部材を備えた圧力切換弁と、前記部品保持具を昇降させる昇降装置により作動させられるとともに、昇降装置の前記部品吸着具を昇降させる昇降駆動部材が部品吸着具を下降させるのに伴って、前記切換部材を前記圧力切換弁が前記部品吸着具内の圧力を大気圧以上の圧力から負圧に切り換える負圧供給位置へ移動させる吸着実現状態と、前記昇降駆動部材が部品吸着具を下降させるのに伴って、切換部材を圧力切換弁が部品吸着具内の圧力を負圧から大気圧以上の圧力に切り換える負圧解除位置へ移動させる解放実現状態とに切換えが可能な切換弁制御装置とを含む実施態様項１５に記載の回路部品搬送装置。回

路部品の吸着時には、昇降駆動部材が部品吸着具を下降させるのに機械的に同期して圧力切換弁の切換部材が負圧供給位置へ移動させられ、圧力切換弁が吸着具内の圧力を大気圧以上の圧力から負圧に切り換え、部品吸着具が回路部品を吸着する。回路部品の解放時には、逆に、昇降駆動部材が部品吸着具を下降させるのに機械的に同期して圧力切換弁の切換部材が負圧解除位置へ移動させられ、圧力切換弁が吸着具内の圧力を負圧から大気圧以上の圧力に切り換え、部品吸着具が回路部品を解放する。圧力切換弁は同じ位置において、１つの昇降装置の昇降駆動部材の下降に伴って２つの状態のいずれかに選択的に切り換えられるのである。本態様によれば、部品吸着具の昇降と負圧の供給，解除の切換えとが機械的に同期して行われ、部品吸着具の下降，上昇タイミングと、負圧の供給，解除タイミングとがずれることがなく、吸着ミスや装着ミスの発生が良好に回避される。また、回路部品の吸着，装着が同じ位置で行われ、圧力切換弁を切り換えるための駆動源が１つで済み、装置を安価に構成することができる。昇降駆動部材は、それ自身が昇降して部品吸着具を昇降させるものとしてもよく、それ自身は部品吸着具の昇降方向とは平行ではない方向に移動し、カム装置，リンク機構等の運動変換装置を介して部品吸着具を昇降させるものとしてもよい。また、昇降駆動部材が自身の移動により切換部材を移動させるようにしてもよく、あるいは他の部材を介して切換部材を移動させるようにしてもよい。

（１７）前記切換弁制御装置が、前記部品吸着具の昇降に伴って機械的に同期することにより互いに逆向きに移動する２つの切換用移動部材と、それら切換用移動部材の各々に設けられ、前記切換部材に互いに反対側から作用する作用部材を各切換用移動部材に対して相対移動させる２つのアクチュエータと、それら２つのアクチュエータを、前記２つの切換用移動部材の移動に伴って前記２つの作用部材の一方ずつが選択的に前記切換部材に作用するように制御するアクチュータ制御装置とを含む実施態様項１６に記載の回路部品装着システム。切換用移動部材を直線移動するものとし、作用部材を切換用移動部材に対して平行な方向に直線移動するものとしてもよく、あるいは交差する方向に直線移動するものとしてもよい。また、切換用移動部材を回動部材とするとともに、作用部材を、切換用移動部材の回動軸線と同じ回動軸線のまわりに回動可能に設けられ、同じ回動軌跡を描く回動部材としてもよい。切換用移動部材の移動方向は昇降駆動部材の移動方向と平行にすることも可能であるが、例えば直交する方向等非平行な方向とすることも可能である。切換部材の移動方向も昇降駆動部材や作用部材の移動方向と平行にすることは不可欠ではなく、また、切換部材の移動は直線運動でも回動でもよい。アクチュエータも直線的に作動するものでも、回転で作動するものでもよい。

（１８）前記切換部材が昇降により前記負圧供給位置と前記負圧解除位置とに移動するものであり、前記２つの切換用移動部材の一方が前記昇降駆動部材と一体的に昇降し、他方が昇降駆動部材の移動方向を逆にして伝達する伝達装置により昇降駆動部材に連携させられている実施態様項１７に記載の回路部品装着システム。２つの切換用移動部材を共に昇降駆動部材に対して相対移動するものとすることも可能であるが、切換用移動部材の一方を昇降駆動部材と一体的に移動するものとすれば、切換弁制御装置を簡単に構成することができる。

（１９）前記切換弁制御装置が、前記２つの切換用移動部材の少なくとも一方とその一方に対応する前記作用部材との間に、主アクチュエータとしての前記アクチュエータと直列に、その対応する作用部材を切換用移動部材に対して相対移動させる補助アクチュエータを少なくとも１個含む実施態様項１７または１８に記載の回路部品装着システム。主アクチュエータと補助アクチュエータとが共に、２つの作動状態を取り得るものであり、補助アクチュエータが１個設けられている場合には、主アクチュエータにより作用部材が切換部材に作用する作用位置と作用しない非作用位置とに移動させられるとともに、作用部材の作用位置が副アクチュエータにより２段階に変更される。副アクチュエータを複数個互いに直列に設ければ、作用部材の非作用位置を多段階に変更可能となる。例えば、回路部品の高さに応じて、部品吸着具が回路部品を吸着する際の高さや解放する際の高さが変わることがあれば、その高さに応じて圧力切換弁の切換時期を設定することにより、より適切な時期に回路部品を吸着し、あるいは解放することができ、搬送能率を向上させることができる。主アクチュエータと補助アクチュエータとは互いに直列に設けられればよく、いずれが作用部材側に設けられてもよい。補助アクチュエータは直線的に作動するものとすることも、回動するものとすることも可能である。

（２０）前記作用部材の一方に、切換部材を介して前記部品吸着具に正圧を供給する正圧供給通路が設けられており、前記解放実現状態の少なくとも初期において前記部品吸着具に正圧が供給される実施態様項１７ないし１９のいずれか１つに記載の回路部品装着システム。

（２１）前記作用部材の前記切換用移動部材との間に、切換用移動部材により作用部材に与えられる作動力が設定値を超えた場合には、作用部材が切換用移動部材に対して相対移動することを、弾性的な抵抗力を付与しつつ許容する相対移動許容装置が設けられた実施態様項１７ないし２０のいずれか１つに記載の回路部品装着システム。圧力切換弁を切換部材のできる限り短い作動ストロークで確実に切り換えるためには、負圧供給位置および負圧解除位置で切換部材の移動を阻止するストッパを設け、そのストッパにより切換部材の移動が阻止された後の切換用移動部材の余分なストロークを相対移動許容装

置に吸収させることが望ましい。

（２２）前記正圧供給通路が設けられた作用部材が前記切換部材に接触した状態においてそれら作用部材と切換部材とに跨がって形成される正圧供給通路の、前記圧力切換弁が負圧供給状態にある状態では前記部品吸着具および負圧源から遮断される部分に設けられ、正圧供給通路から気体が大気中に流出することを、その流出気体に絞り効果を与えつつ許容する流出許容手段が設けられた実施態様項２０または２１に記載の回路部品搬送装置。

（２３）前記流出許容手段が、前記正圧供給通路が設けられた作用部材に、その作用部材が前記切換部材に接触した状態においても正圧供給通路を大気に連通させる状態で形成された連通路を含む実施態様項２２に記載の回路部品搬送装置。

（２４）前記流出許容手段と、前記作用部材が切換部材に接触した状態においてそれら作用部材と切換部材とに跨がって形成される正圧供給通路の流出許容手段より上流側の部分との少なくとも一方に、可変絞り手段が設けられた実施態様項２２または２３に記載の回路部品搬送装置。可変絞り手段の調節により、部品吸着具内の圧力増大後における部品吸着具からの圧力気体の噴出流量を調節したり、圧力切換弁の負圧解除状態への切換直後と部品吸着具内の圧力増大後とにおける部品吸着具への圧力気体の流量の比を調節したりすることができる。

（２５）前記部品保持具が前記保持具旋回装置により部品保持具の軸線まわりに回転可能かつ軸方向に移動可能に保持されており、かつ、当該回路部品装着システムが、さらに、前記旋回軸線に対して同心に設けられ、駆動源により任意の角度回転させられる駆動歯車と、前記部品保持具の各々に同心に固定され、前記駆動歯車とかみ合わされた複数の被駆動歯車とを含み、かつ、前記駆動歯車と前記被駆動歯車とが前記昇降装置による前記部品保持具の軸方向移動にかかわらずかみ合い状態を保つものである請求項１ないし９，実施態様項１ないし２４のいずれか１つに記載の回路部品装着システム。駆動源，駆動歯車，被駆動歯車等が、各部品保持具の軸方向の移動を許容しつつ、部品保持具を一斉に回転させる保持具回転装置を構成することとなる。

（２６）前記駆動歯車が前記被駆動歯車より幅の広いものである実施態様項２５に記載の回路部品装着システム。被駆動歯車を駆動歯車より幅の広いものとすることによっても目的を達し得るが、本態様によれば、１個の歯車の幅を広くすればよく、かつ、部品保持具の軸方向移動を可能にするために必要な被駆動歯車の移動スペースが小さくて済む特有の効果が得られる。

（２７）さらに、回路基材を搬送するとともに位置決めして支持するメインコンベヤと、回路基材を搬送してメインコンベヤに引き渡す搬入コンベヤとメインコンベヤから回路基材を受け取って搬出する搬出コンベヤとの少なくとも一方とを含み、かつ、前記メインコンベヤを前記回路基材の搬送方向に直角な方向に複数並列に配設するとともに、前記搬入コンベヤと搬出コンベヤとの少なくとも一方を、それら少なくとも一方が複数のメインコンベヤの各々とつらなる複数のシフト位置に選択的にシフトさせるコンベヤシフト装置を含む請求項１ないし９，実施態様項１ないし２６のいずれか１つに記載の回路部品装着システム。メインコンベヤは、回路基材の搬送機能と位置決め支持機能とを有し、回路基材を位置決めして支持する部分が回路基材保持装置を構成している。搬入コンベヤは、コンベヤシフト装置によってシフトさせられることにより、複数のシフト位置のうちの任意の位置において回路基材を受け取り、複数のメインコンベヤのいずれへも搬入することができる。搬出コンベヤは、コンベヤシフト装置によってシフトさせられることにより、複数のメインコンベヤのいずれからも回路基材を受け取り、複数のシフト位置のうちの任意の位置において回路基材を搬出することができる。メインコンベヤが複数設けられており、一方のメインコンベヤにより支持された回路基材への回路部品の装着後、直ちに他方のメインコンベヤにより支持された回路基材への回路部品の装着を開始することができ、回路基材の交替時間が実質的に０であり、１つずつの搬入コンベヤ，搬出コンベヤによって複数のメインコンベヤに回路基材を搬入し、搬出することができ、作業能率が高く、かつ、構成が簡単な回路部品装着システムが得られる。搬入コンベヤと搬出コンベヤとは、両方設けてもよく、いずれか一方のみを設けてもよい。例えば、回路基材に対して何らかの作業を行う作業装置が複数直列に並べられてライン状の作業システムを構成しており、本態様に係る回路部品装着システムがラインの最下流に設けられていて、作業の済んだ回路基材がストッカ等の収納装置に収納されるのであれば、ロボットや作業者によりメインコンベヤから取り出して収納装置に収納することが可能であり、搬出コンベヤによる搬出が不可欠ではないのである。このようなシステムにおいては、搬入コンベヤのみが設けられることとなるが、１つの搬入コンベヤによって複数のメインコンベヤの１つに選択的に回路基材を引き渡すことができる。また，例えば、本態様の回路部品作業システムがライン状の作業システムの最上流に設けられていて、ロボットや作業者等によりメインコンベヤに回路基材がセットされたり、あるいは回路基材供給装置が複数の基板引渡部を有していて、複数のメインコンベヤの各々に回路基材が引き渡されるのであれば、搬入コンベヤは不可欠ではない。このようなシステムにおいても、１つの搬出コンベヤがシフトさせられて複数のメインコンベヤから選択的に回路基材を搬出することができる。

（２８）前記複数の部品保持具，前記保持具旋回装置，前記搬送用移動装置，前記昇降装置および前記受取装着制御装置を含む装着ユニットが、前記複数のメインコンベヤのいずれに位置決め支持されている回路基材に対し

ても回路部品を装着し得るものである実施態様項２７に記載の回路部品装着システム。装着ユニットは、複数のメインコンベヤのうちの１つに位置決め支持されている回路基材への回路部品の装着が終了すれば、直ちに、別のメインコンベヤに位置決め支持されて待機している回路基材への回路部品の装着を開始し、能率良く回路部品の装着を行うことができる。装着ユニットはいずれのメインコンベヤ上の回路基材に対しても回路部品を装着し得るため、装着ユニットを１つ設けるのみでもよいが、複数設けて、一部の装着ユニットの部品保持具が回路部品供給装置から回路部品を取り出す間も別の装着ユニットが回路部品を回路基材に装着するようにすれば、回路部品の取出しのために装着を中断せずに済み、能率良く回路部品を装着することができる。

（２９）前記メインコンベヤが２つ並列に配設され、それら２つのメインコンベヤの各外側方にそれぞれ前記部品供給装置が配設されており、前記複数の部品保持具，前記保持具旋回装置，前記搬送用移動装置，前記昇降装置および前記受取装着制御装置を含む装着ユニットが２つ設けられ、それら２つの装着ユニットが、前記２つの部品供給装置の各々から回路部品を受け取り、前記２つのメインコンベヤの任意のものの上方に搬送してそのメインコンベヤに位置決め支持されている回路基材に装着する実施態様項２７に記載の回路部品装着システム。装着ユニットが２つで交互に回路部品を装着するようにすれば、時間の無駄なく回路部品を装着することができるが、交互に回路部品を装着するようにすることは不可欠ではない。そのようにしなくても、例えば、比較的小形の２つの部品供給装置から多種類の回路部品を供給することが可能であり、装着ユニットの移動距離の増大を回避しつつ、多種類の回路部品を必要とする回路の形成を行うことができる効果が得られるのである。

（３０）前記メインコンベヤの上流側に前記搬入コンベヤが、下流側に前記搬出コンベヤがそれぞれ配設され、かつ、それら搬入コンベヤおよび搬出コンベヤの前記複数のシフト位置のうちの予め定められた基準シフト位置にそれぞれ隣接して、搬入コンベヤに回路基材を引き渡す上流側装置と搬出側コンベヤから回路基材を受け取る下流側装置とが配設されている実施態様項２７ないし２９のいずれか１つに記載の回路部品装着システム。上流側装置には、例えば、回路基材供給装置，回路部品装着システム，回路基材に接着剤やペースト状半田を塗布する塗布システム等があり、下流側装置には、例えば、回路部品装着システム，回路部品を回路基材に仮止めしている接着剤を硬化させる硬化炉，半田を溶融させて回路部品を回路基材に電気的に接続するリフロー炉等がある。搬入コンベヤは複数のシフト位置のいずれにおいても回路基材を受け取ることができ、搬出コンベヤは複数のシフト位置のいずれにおいても回路部品を引き渡すことができるため、上流側装置および下流側装置の各回路基材引渡位置および受取位置が１つであって、その位置が搬入コンベヤおよび搬出コンベヤのシフト方向において決まっていても、上流側装置および下流側装置の各回路基材引渡位置および受取位置と一致するシフト位置を当該回路部品装着システムの基準シフト位置として三者を接続すれば、回路基材の受渡しを支障なく行うことができる。

（３１）前記メインコンベヤの上流側に前記搬入コンベヤが、下流側に前記搬出コンベヤがそれぞれ配設された実施態様項２７ないし２９のいずれか１つに記載の回路部品装着システム。搬入コンベヤおよび搬出コンベヤは、メインコンベヤと共に搬送方向を逆にすれば、それぞれ搬出コンベヤおよび搬入コンベヤとして機能するようにすることができる。

（３２）実施態様項３１に記載の回路部品装着システムが少なくとも２つ直列に配列された回路部品装着システム。この回路部品装着システムにおいては、上流側の回路部品装着システムの搬出コンベヤと下流側の回路部品装着システムの搬入コンベヤとの間で回路基材の受渡しが行われる。搬出コンベヤも搬入コンベヤも複数のシフト位置に選択的にシフトさせることができ、複数のシフト位置のうちの任意の１つにおいて回路基材の受渡しが行われる。回路基材の受渡しが行われるシフト位置を１つに決めなくてもよく、隣接する２つの回路部品装着システムの装着の進行度に応じて決定することができ、回路部品装着システムの自由度が向上する。

（３３）前記メインコンベヤの上流側に、前記搬入コンベヤと前記搬出コンベヤとを兼ねた搬入搬出コンベヤが配設された実施態様項２７ないし２９のいずれか１つに記載の回路基材作業システム。搬入搬出コンベヤは正方向と逆方向とに回路基材を搬送可能なものであり、正方向に搬送する状態で搬入コンベヤとして機能し、逆方向に搬送する状態で搬出コンベヤとして機能する。本態様は、回路基材を供給された側と同じ側へ排出することが望ましい特殊な場合に有効である。

（３４）前記コンベヤシフト装置が、前記搬入コンベヤと前記搬出コンベヤとを互いに独立にシフトさせる搬入コンベヤシフト装置と搬出コンベヤシフト装置とを含む実施態様項３０ないし３２のいずれか１つに記載の回路部品装着システム。コンベヤシフト装置を、搬入コンベヤと搬出コンベヤとを一斉にシフトさせるものとすることも可能であるが、独立にシフトさせるものとすれば、回路部品装着システムの自由度が向上する。

（３５）前記コンベヤシフト装置が、前記搬入コンベヤと搬出コンベヤとの少なくとも一方を支持するコンベヤ支持台と、そのコンベヤ支持台をシフトさせる流体圧シリンダとを含む実施態様項２７ないし３４のいずれか１つに記載の回路部品装着システム。流体圧シリンダを使用すれば、搬入コンベヤや搬出コンベヤを迅速にシフトさせ得るコンベヤシフト装置を安価に製造することがで

きる。

（３６）前記流体圧シリンダが、前記複数のシフト位置に跨がって配設されたロッドレスシリンダである実施態様項３５に記載の回路部品装着システム。ロッドレスシリンダを使用すれば、ピストンロッドを備えた流体圧シリンダを使用する場合に比較して、コンベヤシフト装置をコンパクトに構成し得る。

（３７）前記コンベヤシフト装置が、前記搬入コンベヤと搬出コンベヤとの少なくとも一方を支持するコンベヤ支持台と、そのコンベヤ支持台を、サーボモータを駆動源としてシフトさせる駆動装置とを含む実施態様項２７ないし３４のいずれか１つに記載の回路部品装着システム。

（３８）前記メインコンベヤが、前記回路基材を搬送面から浮かして位置決め支持する基板位置決め支持装置を含む実施態様項２７ないし３７のいずれか１つに記載の回路部品装着システム。この態様の装置によれば、回路基材を確実に位置決めし得る。

（３９）前記複数のメインコンベヤがそれぞれ回路基材を支持して搬送するコンベヤベルトを備え、かつ、それら複数のメインコンベヤのコンベヤベルトが共通のベルト駆動源により一斉に駆動される実施態様項３８に記載の回路部品装着システム。基板位置決め支持装置が回路基材を搬送面から浮かして位置決め支持するものであれば、複数のメインコンベヤのコンベヤベルトを一斉に作動させても作業が行われている回路基材が移動することはない。また、ベルト駆動源を共通にすれば装置コストを低減させることができる。

（４０）前記メインコンベヤ，前記搬入コンベヤおよび前記搬出コンベヤの各々の両サイドフレームの少なくとも一方が他方に対して接近，離間可能な可動フレームとされており、かつ、メインコンベヤ，搬入コンベヤおよび搬出コンベヤの各可動フレームを同時に移動させてメインコンベヤ，搬入コンベヤおよび搬出コンベヤの搬送幅を同時に変更する幅変更装置を含む実施態様項３０ないし３２，３４ないし３９のいずれか１つに記載の回路基材作業システム。

（４１）前記メインコンベヤ，前記搬入コンベヤおよび前記搬出コンベヤの各々の両サイドフレームの少なくとも一方が他方に対して接近，離間可能な可動フレームとされており、かつ、搬入コンベヤと搬出コンベヤとの各可動フレームを同時に移動させて搬入コンベヤと搬出コンベヤとの搬送幅を同時に変更する幅変更装置と、その幅変更装置による幅変更時にメインコンベヤの可動フレームと、搬入コンベヤおよび搬出コンベヤの可動フレームとを一体的に移動する状態に連結するフレーム連結装置とを含む実施態様項３０ないし３２，３４ないし３９のいずれか１つに記載の回路基材作業システム。フレーム連結装置は、メインコンベヤの可動フレームと、搬入コンベヤおよび搬出コンベヤの可動フレームとを連結する連結位置と、連結しない非連結位置とに位置可能な連結部材を有する。連結部材は作業者の操作により連結位置と非連結位置とに位置させられるものとしてもよく、あるいは連結部材駆動装置により駆動されて自動的に連結位置と非連結位置とに位置させられるものとしてもよい。

（４２）前記幅変更装置が、前記搬入コンベヤと前記搬出コンベヤとの各々に対応して設けられ、それらコンベヤの前記複数のシフト位置に跨がって延びる搬入側駆動軸および搬出側駆動軸と、前記搬入コンベヤと前記搬出コンベヤとにそれぞれ回転可能かつ軸方向に移動不能に保持され、前記搬入側駆動軸および搬出側駆動軸にそれぞれ相対回転不能かつ軸方向に相対移動可能に係合する被駆動回転体と、その被駆動回転体の回転を前記可動フレームの運動に変換する運動変換装置と、幅変更用回転駆動源と、その幅変更用回転駆動源の回転を前記搬入側駆動軸および搬出側駆動軸に伝達する回転伝達装置とを含む実施態様項４０または４１に記載の回路基材作業システム。この態様によれば、幅変更用回転駆動源を搬入コンベヤと搬出コンベヤとに共用でき、かつ、両コンベヤの幅変更を同時に行うことが容易となる。しかも、搬入コンベヤと搬出コンベヤとのシフトを独立に行うことができる。また、搬入コンベヤおよび搬出コンベヤをシフトさせても、搬入コンベヤおよび搬出コンベヤの各被駆動回転体は搬入側駆動軸および搬出側駆動軸に係合した状態を保つため、搬入，搬出コンベヤが複数のシフト位置のうちのいずれにあっても搬送幅を変更することができる。

（４３）前記幅変更装置がさらに、前記複数のメインコンベヤのうちの１つに、それらメインコンベヤが並ぶ方向に設けられたメインコンベヤ側駆動軸と、そのメインコンベヤ側駆動軸が設けられたメインコンベヤに回転可能かつ軸方向に移動不能に保持され、前記メインコンベヤ側駆動軸に相対回転不能かつ軸方向に相対移動可能に係合する被駆動回転体と、前記複数のメインコンベヤの各可動フレームを一体的に連結する連結部材とを含むとともに、前記回転伝達装置が前記幅変更用回転駆動源の回転を前記搬入側駆動軸および搬出側駆動軸に加えて、前記メインコンベヤ側駆動軸に伝達するものである実施態様項４２に記載の回路基材作業システム。

（４４）前記メインコンベヤと、前記搬入コンベヤと搬出コンベヤとの少なくとも一方とがそれぞれ回路基材を支持して搬送するコンベヤベルトを備え、かつ、メインコンベヤと、搬入コンベヤと搬出コンベヤとの少なくとも一方とがそれぞれ独自のベルト駆動源を備えた実施態様項２７ないし４３のいずれか１つに記載の回路部品装着システム。

メインコンベヤ，搬入コンベヤおよび搬出コンベヤのベルト駆動源をそれぞれ専用にすれば、各コンベヤを独立に作動させることができ、回路部品装着システムの自由

度が向上する。

【００１６】

【発明の実施の形態】以下、第１ないし第９発明に共通の実施形態である回路部品装着システムを図面に基づいて説明する。本回路部品装着システム８は、回路基材の搬送方向において上流側に設けられた上流側装置であって、塗布システムの一種であり、回路部品にペースト状半田を印刷するスクリーン印刷システムと、下流側に設けられた下流側装置たるリフローシステム（半田を溶融させて回路部品を回路基材に電気的に接続するシステム）と共に電子回路組立ラインを構成している。電子回路組立ラインもプリント基板作業システムの一種である。

【００１７】回路部品装着システム８を説明する。図１において１０は基台である。基台１０上には、基板コンベヤ１２；２個ずつの回路部品供給装置１４，１６および回路部品装着装置１８，２０が設けられている。基板コンベヤ１２は、２つのメインコンベヤ４００，４０２と、１つずつの搬入コンベヤ４０４および搬出コンベヤ４０６とを備えている。これらメインコンベヤ４００，４０２は、回路基材たるプリント基板４０８（図３参照）の搬送方向（図１において左右方向であり、プリント基板４０８の搬送方向をＸ軸方向とする）と水平面内において直角な方向（Ｙ軸方向とする）に並列に配設されている。

【００１８】搬入コンベヤ４０４を説明する。図２に示すように、基台１０上には、案内部材支持台４２０が高さ調節部材たる複数本のアジャストボルト４２２により高さ調節可能に取り付けられている。案内部材支持台４２０は図４に示すように矩形の枠状を成し、メインコンベヤ４００および４０２の両方にわたって隣接する長さを有する。案内部材支持台４２０のＹ軸方向に平行な一対の枠部上にはそれぞれ、案内部材たる直線状のガイドレール４２４が固定されるとともに、図２および図４に示すように、コンベヤ支持台４２６が４個の被案内部たるガイドブロック４２８において移動可能に嵌合されており、コンベヤ支持台４２６上に搬入コンベヤ４０４が設けられている。

【００１９】コンベヤ支持台４２６は矩形の枠状を成し、図４に示すように、Ｙ軸方向に平行な一対の枠部４３０を連結する連結部材４３２の長手方向の中央部において、ロッドレスシリンダ４３６の移動子に固定されている。ロッドレスシリンダ４３６はピストンロッドのない空気圧シリンダである。ロッドレスシリンダ４３６においては、ピストンと一体的に設けられた図示しない移動子が気密を保ってハウジング外へ突出させられており、その移動子に連結部材４３２が固定されている。ロッドレスシリンダ４３６は、前記案内部材支持台４２０上にＹ軸方向に平行に設けられており、コンベヤ支持台４２６がロッドレスシリンダ４３６によって移動させられることにより、搬入コンベヤ４０４がメインコンベヤ４００につらなる第１シフト位置と、メインコンベヤ４０２につらなる第２シフト位置とにシフトさせられる。これらコンベヤ支持台４２６およびロッドレスシリンダ４３６が搬入コンベヤシフト装置４３８を構成している。搬入コンベヤ４０４が第１シフト位置に位置するか、第２シフト位置に位置するかは、ロッドレスシリンダ４３６においてピストンの移動端への移動が移動端検出装置によって検出されることによりわかる。

【００２０】搬入コンベヤ４０４は、図４に示すように、サイドフレームたる固定フレーム４４０および可動フレーム４４２を有する。これらフレーム４４０，４４２はコンベヤ支持台４２６の基板搬送方向の寸法より長い長手形状を成し、固定フレーム４４０はコンベヤ支持台４２６の基板搬送方向に平行な一方の端部に基板搬送方向と平行に固定され、可動フレーム４４２は、基板搬送方向と平行に配設されるとともに、コンベヤ支持台４２６に、基板搬送方向と直角な方向に移動可能であって、固定フレーム４４０に対して接近，離間可能に取り付けられている。

【００２１】コンベヤ支持台４２６の基板搬送方向に平行な端部であって、固定フレーム４４０が固定された側とは反対側の端部には、基板搬送方向と平行に延びる支持部４４４が設けられており、固定フレーム４４０と支持部４４４とには、案内部材たる一対の直線状のガイドレール４４６の両端部が固定されるとともに、ねじ軸４４８の両端部が回転可能に支持されている。ガイドレール４４６およびねじ軸４４８は可動フレーム４４２の移動方向と平行に配設されているのであり、ガイドレール４４６には、可動フレーム４４２に固定された被案内部材たるガイドブロック４５０が移動可能に嵌合され、ねじ軸４４８には、可動フレーム４４２に固定されたナット４５２が螺合されている。これらねじ軸４４８およびナット４５２は図示しない鋼球を介して作動するボールねじを構成している。したがって、ねじ軸４４８が回転させられれば、可動フレーム４４２がガイドレール４４６により案内されて固定フレーム４４０に接近，離間させられる。

【００２２】前記案内部材支持台４２０には、図４に示すように、スプライン軸４５６がＹ軸方向に平行な軸線のまわりに回転可能に取り付けられている。スプライン軸４５６は、図２および図４に示すように、第１，第２シフト位置に跨がって設けられ、固定フレーム４４０および可動フレーム４４２の下側に位置する。スプライン軸４５６には、固定フレーム４４０にブラケット４５７（図３参照）によって回転可能かつ軸方向に移動不能に取り付けられたスプライン部材４５８が相対回転不能かつ軸方向に移動可能に嵌合されている。スプライン部材４５８は、スプライン軸４５６とスプライン嵌合するスプライン穴を備えた部材であり、このスプライン部材４

５８にはスプロケット４６０が一体的に設けられている。スプロケット４６０と、前記ねじ軸４４８に固定されたスプロケット４６２とにチェーン４６４（図３参照。図４ではチェーン４６４の図示は省略されている。）が巻きかけられており、スプライン軸４５６の回転がねじ軸４４８に伝達される。４６６はテンションスプロケットである。

【００２３】スプライン軸４５６の固定フレーム４４０から外側（可動フレーム４４２とは反対側）へ突出させられた端部には、図２および図４に示すように、スプロケット４６８が固定されている。スプライン軸４５６は、スプロケット4.6８に巻きかけられたチェーン４７０（図２および図４参照）が移動させられることにより回転させられ、それによりねじ軸４４８が回転させられて可動フレーム４４２が移動させられ、搬入コンベヤ４０４の搬送幅が変更される。搬入コンベヤ４０４がコンベヤ支持台４２６の移動によりシフトさせられるとき、スプライン部材４５８に固定のスプロケット４６０は固定フレーム４４０と共にスプライン軸４５６に対して軸方向に移動するが、スプライン嵌合したままであって回転が伝達される状態に保たれ、搬入コンベヤ４０４がいずれのシフト位置に位置してもねじ軸４４８に回転が伝達されて搬送幅が変更される。なお、搬入コンベヤ４０４の搬送幅の変更は、メインコンベヤ４００，４０２および搬出コンベヤ４０６の搬送幅の変更と同時に行われるため、チェーン４７０の配設および駆動源については後に説明する。

【００２４】固定フレーム４４０およびコンベヤ支持台４２６の支持部４４４はまた、図４に示すように、Ｙ軸方向に平行に配設された回転伝達軸たるスプライン軸４８０の両端部を回転可能に支持している。スプライン軸４８０の可動フレーム４４２側の端部は、可動フレーム４４２に回転可能かつ軸方向に移動不能に取り付けられたスプライン部材４８２に相対回転不能かつ軸方向に移動可能に係合されている。スプライン軸４８０の固定フレーム４４０から外側へ突出した端部には、スプロケット４８４が固定されるとともに、ベルト駆動源たる基板搬送用モータ４８６の出力軸に固定のスプロケット４８８（図２参照）にチェーン４９０によって連結されている。基板搬送用モータ４８６はＡＣ三相モータの一種であるインダクションモータである。

【００２５】スプライン軸４８０の固定フレーム４４０側の端部に一体的に設けられたプーリ４９２（図２参照）および固定フレーム４４０に取り付けられた複数のプーリ４９４（図４には２個のみ図示されている）には、図示しないコンベヤベルトが巻きかけられている。スプライン部材４８２にも図示しないプーリが一体的に設けられており、このプーリおよび可動フレーム４４２に回転可能に取り付けられた複数のプーリ４９６（図４には２個のみ図示されている）にコンベヤベルトが巻きかけられている。したがって、基板搬送用モータ４８６が起動されれば、スプライン軸４８０が回転させられるとともにプーリ４９２等が回転させられ、一対のコンベヤベルトが移動させられてコンベヤベルト上に載せられたプリント基板４０８が送られる。基板搬送用モータ４８６はコンベヤ支持台４２６に取り付けられており，搬入コンベヤ４０４と共に移動させられ、搬入コンベヤ４０４が第１，第２シフト位置のいずれに位置する状態においても、プリント基板搬送用の駆動源として機能する。

【００２６】プリント基板４０８の移動は、固定フレーム４４０と可動フレーム４４２とにそれぞれ固定された長手形状の案内部材４９８，５００（図４参照）の垂直な案内面により、幅方向の両側から案内される。案内部材４９８，５００には、コンベヤベルト上へ延び出す押さえ部が設けられ、プリント基板４０８のコンベヤベルトからの浮上がりを防止する。

【００２７】固定フレーム４４０の基板搬送方向において下流側の部分には、図４に示すように、プリント基板の到着を検出する基板到着確認センサ５０４が取り付けられている。基板到着確認センサ５０４は、発光部および受光部を含む反射型の光電センサであるが、発光部および受光部を含む透過型の光電センサ，リミットスイッチ，近接スイッチ等、種々のセンサの採用が可能である。

【００２８】搬出コンベヤ４０６は搬入コンベヤ４０４と同様に構成されており、対応する部分には同一の符号を付して説明を省略する。なお、コンベヤ支持台４２６およびロッドレスシリンダ４３８は、搬出コンベヤ４０６においては、搬出コンベヤシフト装置５０８を構成し、搬入コンベヤ４０４と搬出コンベヤ４０６とはそれぞれ、搬入コンベヤシフト装置４３８と搬出コンベヤシフト装置５０８とによって互いに独立にシフトさせられる。なお、搬出コンベヤ４０６側には、図１に示すように、搬送幅変更用の操作部材たるハンドル５１０が設けられている。基台１０上にはブラケット５１２によって回転軸５１４がＹ軸方向に平行な軸線まわりに回転可能に取り付けられるとともに、一端部にハンドル５１０が固定され、他端部にはスプロケット５１６が固定されている。スプロケット５１６には、前記チェーン４７０が巻きかけられている。チェーン４７０はまた、ブラケット５１２に回転可能に取り付けられたスプロケット５１８にも巻きかけられている。

【００２９】メインコンベヤ４００，４０２を説明する。メインコンベヤ４００，４０２の構成はほぼ同じであり、メインコンベヤ４００を主に説明する。基台１０の搬入コンベヤ４０４と搬出コンベヤ４０６との間の部分には、図２および図４に示すように、コンベヤ支持台５２０が固定されている。コンベヤ支持台５２０は、Ｙ軸方向においてメインコンベヤ２個分の大きさを有し、

コンベヤ支持台５２０のＹ軸方向に平行な両端部にはそれぞれ、案内部材たる直線状のガイドレール５２２（図４参照）が固定されている。

【００３０】メインコンベヤ４００は、サイドフレームたる固定フレーム５２４および可動フレーム５２６を有する。これらフレーム５２４，５２６はそれぞれ、図２に固定フレーム５２４を代表的に示すように、一対の脚部５２８と、それら脚部５２８の上端部を連結する連結部５３０とを有する門形を成し、固定フレーム５２４は一対の脚部５２８においてコンベヤ支持台５２０に固定されている。可動フレーム５２６の一対の脚部５２８にはそれぞれ、被案内部材たるガイドブロック５３２が固定されるとともに、ガイドレール５２２に移動可能に嵌合されている。

【００３１】メインコンベヤ４００の固定フレーム５２４の一対の脚部５２８にはそれぞれ、図４および図５に示すように、ねじ軸５３６の一端部が回転可能かつ軸方向に移動不能に取り付けられている（図４には一方のねじ軸５３６のみが図示されている）。これら一対のねじ軸５３６はそれぞれ、図５に示すように、メインコンベヤ４００の可動フレーム５２６の基板搬送方向に平行な方向の両端部にそれぞれ固定されたナット５３８に螺合されるとともに、可動フレーム５２６から突出した他端部は、メインコンベヤ４０２の固定フレーム５２４により回転可能に支持されている。これらねじ軸５３６およびナット５３８は、ボールねじを構成している。また、メインコンベヤ４００および４０２の各可動フレーム５２６は、連結部材５４０により連結されており、一体的に移動させられる。

【００３２】上記一対のねじ軸５３６のメインコンベヤ４００の固定フレーム５２４からの突出端部にはそれぞれ、図２および図５に示すように、スプロケット５４２が固定されている。前記チェーン４７０は、図２および図６に示すように、スプロケット５４２と、コンベヤ支持台５２０と固定フレーム５２４とにそれぞれ取り付けられた複数のスプロケット５４４とに巻きかけられている。したがって、前記ハンドル５１０が作業者により回転操作されれば、チェーン４７０が移動させられ、メインコンベヤ４００の２本のねじ軸５３６が回転させられるとともに、搬入コンベヤ４０４および搬出コンベヤ４０６の各スプライン軸４５６が回転させられてねじ軸４４８が回転させられる。それによりコンベヤ４００～４０６の各可動フレーム４４２，５２６が一斉に同じ方向へ同じ距離移動させられ、コンベヤ４００～４０６の各搬送幅が同時に同じ大きさに変更される。メインコンベヤ４００および４０２の各可動フレーム５２６は、連結部材５４０により連結されており、ねじ軸５３６の回転によってメインコンベヤ４００の可動フレーム５２６が移動させられることにより、メインコンベヤ４０２の可動フレーム５２６も移動させられて搬送幅が変更される。

【００３３】固定フレーム５２４および可動フレーム５２６の各連結部５３０の互いに対向する面にはそれぞれ、基板搬送方向において隔たった両端部を始めとし、複数箇所に図示しないプーリが回転可能に取り付けられるとともに、無端のコンベヤベルト５４６（図５参照）が巻きかけられている。これらコンベヤベルト５４６はそれぞれ、固定フレーム５２４と可動フレーム５２６とによって回転可能に支持されたスプライン軸５４８が回転させられることにより移動させられる。

【００３４】メインコンベヤ４００のスプライン軸５４８は、図５に示すように、固定フレーム５２４によって回転可能に支持されるとともに、可動フレーム５２６に回転可能かつ軸方向に移動不能に取り付けられたスプライン部材５５０が相対回転不能かつ軸方向に移動可能に嵌合されている。スプライン軸５４８の固定フレーム５２４側の端部と、スプライン部材５５０とにはそれぞれ、プーリ５５３が一体的に設けられ、コンベヤベルト５４６が巻きかけられている。スプライン軸５４８はさらに、メインコンベヤ４００の可動フレーム５２６から突出させられ、メインコンベヤ４０２の固定フレーム５２４により回転可能に支持されるとともに、プーリ５５３が一体的に設けられてコンベヤベルト５４６が巻きかけられている。このスプライン軸５４８と、メインコンベヤ４０２に設けられたスプライン軸５４８とは継手部材５５２により連結され、一体的に回転させられる。

【００３５】メインコンベヤ４０２のスプライン軸５４８は、図５に示すように、可動フレーム５２６から突出させられるとともに、突出端部はコンベヤ支持台５２０に固定の支持部材５５４により回転可能に支持されている。この突出端部にはスプロケット５５６が固定されるとともに、支持部材５５４に取り付けられた基板搬送用モータ５５８の出力軸に固定のスプロケット５６０（図４参照）にチェーン５６２によって連結されている。基板搬送用モータ５５８は、ＡＣ三相モータの一種であるスピードコントロールモータである。

【００３６】したがって、基板搬送用モータ５５８が起動されれば、２本のスプライン軸５４８が一体的に回転させられ、プーリ５５３の回転によりコンベヤベルト５４６が移動させられてプリント基板４０８が送られる。なお、コンベヤベルト５４６の移動は、固定フレーム５２４および可動フレーム５２６に固定のベルトガイド５６４（図５参照）により案内される。また、プリント基板４０８の移動は、固定フレーム５２４および可動フレーム５２６にそれぞれ固定の案内部材５６６，５６８の垂直な案内面により幅方向の両側から案内され、プリント基板４０８のコンベヤベルト５４０からの浮上がりは案内部材５６６，５６８に突設された押さえ部５７０，５７２により防止される。押さえ部５７０，５７２とコンベヤベルト５４６の上面との間には、プリント基板４

０８の厚さより大きい隙間があり、コンベヤベルト５４６上に載置されたプリント基板４０８と押さえ部５７０，５７２との間には僅かに隙間が設けられる。搬送幅の変更時に、スプライン部材５５０はスプライン軸５４８に対して軸方向に移動するが、スプライン嵌合した状態に保たれ、搬送幅が変更されてもプーリ５５３に基板搬送用モータ５５８の回転が伝達され、プリント基板４０８が搬送される。

【００３７】固定フレーム５２４および可動フレーム５２６の互いに対向する面には更に、図５に示すように、突上部材５８０がそれぞれ昇降可能に取り付けられている。突上部材５８０は薄い板状を成し、固定フレーム５２４および可動フレーム５２６とほぼ同じ長さを有し、固定フレーム５２４および可動フレーム５２６にそれぞれ、昇降可能に取り付けられた保持部材５８２に固定されて、コンベヤベルト５４６の内側（他方のコンベヤベルト５４６側）に位置させられている。

【００３８】保持部材５８２の下面の長手方向に隔たった両端部にはそれぞれ、係合部材５８４（図２参照）が下向きに突設されている（図２には一方の係合部材５８４のみ図示されている）。保持部材５８２は、前記連結部５３０との間に配設された付勢手段の一種である弾性部材としての圧縮コイルスプリング５８６（図２参照）により下方へ付勢されており、突上部材５８０は、常には、上端面がプリント基板４０８の搬送面（環状に配設されたコンベヤベルト５４６の上側の水平部の上面を含む面）より下方であって、プリント基板４０８と干渉しない退避位置に退避させられている。

【００３９】前記コンベヤ支持台５２０上には、図５に示すように、昇降台５９８および昇降台昇降装置６００が設けられている。昇降台５９８は、メインコンベヤ４００，４０２が搬送するプリント基板４０８のうち、最も大きいプリント基板４０８より大きい寸法を有する。なお、前記可動フレーム５２６の前記一対の脚部５２８間の距離は、昇降台５９８のＸ軸方向の寸法より大きくされ、搬送幅の変更時に昇降台５９８と干渉しないようにされている。また、昇降台５９８上には、基板支持部材たる複数の基板吸着具６０２が位置調節可能に設けられている（図１，図４および図５には、１つのみ図示されている）。基板吸着具６０２は、図示しない真空装置により供給される負圧によってプリント基板４０８を吸着する。

【００４０】昇降台昇降装置６００は、コンベヤ支持台５２０上にＸ軸方向に平行な軸線まわりに回動可能に取り付けられた一対の回動軸６０８を有し、各回動軸６０８の両端部にはそれぞれ、レバー６１０の一端部（図５参照）が相対回転不能に取り付けられている。これら４本のレバー６１０の各自由端部に回転可能に取り付けられたローラ６１２はそれぞれ、昇降台５９８の下面に一体的に設けられた係合凹部６１４（図２参照）に回転可能に嵌合されている。一対の回動軸６０８は一体的に回動するように連結されており、一方の回動軸６０８が図示しない駆動シリンダによって回動させられれば、４個のレバー６１０が同時に回動させられて昇降台５９８が水平な姿勢を保って昇降させられる。昇降台５９８の昇降は、図５に示すように、昇降台５９８に固定のガイドロッド６１６と、コンベヤ支持台５２０上に固定のガイド筒６１８との嵌合により案内される。

【００４１】昇降台５９８が上昇させられるとき、基板吸着具６０２が負圧によりプリント基板４０８を吸着し、基板吸着具６０２のゴム製の吸着カップに覆われた支持部材の支持面がプリント基板４０８を下方から支持する。また、昇降台５９８は係合部材５８４に係合し、保持部材５８２、ひいては突上部材５８０を圧縮コイルスプリング５８６の付勢力に抗して上昇させ、プリント基板４０８をコンベヤベルト５４６上から突き上げさせる。プリント基板４０８は基板吸着スプリング６０２により吸着されて下方から支持されるとともに、コンベヤベルト５４６から持ち上げられて突上部材５８０と案内部材５６６，５６８の押さえ部５７０，５７２とに挟まれ、上方あるいは下方への反りが修正された状態でメインコンベヤ４００，４０２に固定される。基板吸着具６０２の昇降台５９８上における位置は、プリント基板４０８の寸法に応じて調節される。プリント基板４０８の寸法が小さい場合は、基板吸着具６０２は省略されることもある。

【００４２】メインコンベヤ４００，４０２の基板搬送方向において下流側にはそれぞれ、図４に示すように、減速開始位置センサ６２０，基板到着確認センサ６２２および基板停止装置６２４が設けられている。減速開始位置センサ６２０および基板到着確認センサ６２２はそれぞれ、発光部および受光部を有する反射型の光電センサにより構成され、プリント基板４０８からの光の反射によりプリント基板４０８の減速開始位置への到達、基板到着確認位置への到達を検出する。昇降台５９８には、切欠６２６が設けられ、光がプリント基板４０８に当たるようにされている。減速開始位置センサ６２０，基板到着確認センサ６２２は、反射型の光電センサに限らず、透過型の光電センサ，近接スイッチ，リミットスイッチ等により構成してもよい。

【００４３】基板停止装置６２４は、両センサ６２０，６２２より下流側に設けられ、ストッパ部材６３０と、ストッパ部材６３０を昇降させる昇降装置６３２とを有する。昇降装置６３２は、図２に示すように流体圧シリンダたるエアシリンダ６３４を駆動源とし、ストッパ部材６３０はエアシリンダ６３４により、搬送面より上方へ突出してプリント基板４０８の移動を止める作用位置と、搬送面の下方へ退避させられてプリント基板４０８の通過を許容する非作用位置とに移動させられる。

【００４４】このように基板コンベヤ１２においてはメ

インコンベヤが２個設けられており、プリント基板４０８の搬送経路がＹ軸方向に並んで２つある。しかし、本回路部品装着システム８の上流側に設けられたスクリーン印刷システムおよび下流側に設けられたリフローシステムはいずれも、プリント基板４０８の搬送経路が１つであって同一線上に位置する装置およびシステムであり、回路部品装着システム８は、メインコンベヤ４００を含む搬送経路がスクリーン印刷システムおよびリフローシステムの搬送経路と一致する位置に設けられ、プリント基板４０８の受渡しが、搬入，搬出コンベヤ４０４，４０６が第１シフト位置に位置する状態で行われるようにされている。本回路部品装着システム８等により構成される電子回路組立ラインの基板搬送方向と直角な方向において作業者が作業を施す側は予め定められており、２つのメインコンベヤ４００，４０２のうち、作業者側となるメインコンベヤ４００がスクリーン印刷システムおよびリフローシステムと並ぶ位置に設けられているのである。

【００４５】回路部品供給装置１４，１６を説明する。回路部品供給装置１４，１６はそれぞれ、メインコンベヤ４００，４０２の外側方に配設されている。回路部品供給装置１４，１６の構成は同じであり、供給する回路部品の種類も同じである。回路部品供給装置１４を代表的に説明する。

【００４６】回路部品供給装置１４は、図７に示すように、本体部としての回路部品供給台車５２（以下、台車５２と略称する）と、台車５２に保持されてそれと共に回路部品供給装置１４を構成する複数のフィーダ５４とを備えている。図７において、フィーダ５４は、想像線（二点鎖線）で示されている。台車５２は、ベース６０と、ハンドル６１と、ベース６０に支持されたフレーム６２と、そのフレーム６２に取り付けられたフレームプレート６３と、フレーム６２上に設けられたフィーダ保持装置６４と、フレーム６２に設けられた２つの係合部６６（図７には一つのみ図示されている）とを主たる構成要素としている。

【００４７】２つの係合部６６は、図８に示すように、前記基台１０に設けられた２つの係合装置６８に係合させられることにより、基台１０と台車５２とを機械的に合体させる。各係合装置６８は、基台１０と台車５２とが並ぶ方向（図８において左右方向）に平行移動し、かつ、その移動方向に平行な軸を回転軸とする回転移動が可能な花弁型の係合突起７０を備えている。上記平行移動は、係合装置６８に内蔵された複動のエアシリンダによって行われる。また、この平行移動の過程で、係合突起７０は、図示しないカム機構によって、その移動方向に平行な軸線まわりに一定角度（例えば、９０度）回転させられるようになっている。

【００４８】基台１０と台車５２とが合体していない状態では、係合突起７０は突出状態にあり、かつ、係合部

６６と軸方向に嵌合可能な回転位相にある。係合部６６は丸穴部７１とその丸穴部７１から互いに逆向きに延びた一対の切欠７２（それらは、水平方向に対峙する。図７には一方の切欠７２のみ図示されている）とを有する開口を備えており、基台１０と台車５２とが合体のために接近させられると、係合突起７０は係合部６６の切欠７２を通過する。その状態で、エアシリンダの一方の圧力室にエアが供給され、他方の圧力室からのエアの流出が許容されると、当初は係合突起７０が正方向に回転させられつつ引っ込まされ、係合突起７０が係合部６６と軸方向に離脱不能に係合する。係合突起７０は、回転を停止した後も一定距離引っ込まされ、それによって台車５２が基台１０に強く引き付けられる。エアの供給状態が逆転させられると、当初は係合突起７０が回転することなく突出させられ、台車５２が基台１０から離間することが許容され、その後、係合突起７０が突出させられつつ回転させられ、係合部６６から軸方向に離脱可能な状態となる。

【００４９】基台１０には、２個のガイドテーパスリーブ７４が設けられている（図８には１個のみ図示されている）。ガイドテーパスリーブ７４は、係合突起７０と係合部６６との係合を妨げない位置において係合部６６に嵌合させられる。具体的には、丸穴部７１と嵌合させられるのであるが、係合突起７０は、ガイドテーパスリーブ７４よりも図８において台車５２側に位置しているので、係合突起７０と係合部６６との係合は妨げられない。２組のガイドテーパスリーブ７４と丸穴部７１との嵌合により、台車５２の基台１０に対する垂直面に平行な方向の位置決めが正確に行われる。

【００５０】図７に示すように、基台１０と台車５２とには、ガイド機構８０が設けられている。ガイド機構８０は、基台１０に取り付けられる２つのガイド部材８２と、台車５２のベース６０に取り付けられる２つのローラ８４とにより構成されている（図７には、ガイド部材８２およびローラ８４はそれぞれ、１つずつ図示されいている）。なお、図７に示すガイド部材８２と台車５２との相対位置は、基台１０と台車５２とが合体させられた後の状態における位置が示されている。この状態では、ベース６０にそれぞれ２つずつ設けられている固定車輪８６と回動可能車輪８８とが床から離れた状態となる。また、ローラ８４もガイド部材８２からわずかではあるが離間した状態となる。基台１０と台車５２とが合体していない状態では、各２つずつの固定車輪８６と回動可能車輪８８とが共に床に支持されており、台車５２は容易に移動させることができる。

【００５１】合体のために基台１０に台車５２が接近させられると、ローラ８４が、ガイド部材８２に形成されている斜面９０上を転がり上がり、その過程で固定車輪８６が床から離間させられる。基台１０と台車５２とがさらに接近させられると、ガイド部材８２に形成された

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ガイドレール９２上をローラ８４が転がる。ガイドレール９２は、ローラ８４との係合によって、基台１０と台車５２との水平方向（図７の紙面に直交する方向）の相対位置を、合体が容易に成され得る位置に調整する機能を果たす。このことにより、丸穴部７１とガイドテーパスリーブ７４との嵌合が容易に開始できるようにされているのである。

【００５２】基台１０には、図示しない検出装置が設けられている。丸穴部７１とガイドテーパスリーブ７４とが嵌合し、当接部９４が基台１０に形成される図示しない突起に当接させられた状態で、上記図示しない検出装置により、台車５２に設けられた合体検出用突起（図示省略）が検出されるようになっている。そして、検出装置により合体検出用突起が検出されると、係合装置６８のエアシリンダが作動させられ、前述のように、係合突起７０が係合部６６に軸方向に離脱不能に係合し、台車５２を基台１０に向かって引き付けて固定する。

【００５３】図８に示すように、台車５２は、係合部６６において基台１０に引き付けられ、係合部６６の当接面９６が係合装置６８側の当接面９７に当接するとともに、前記当接部９４において基台１０に形成される図示しない突起に当接させられることにより、台車５２の合体方向の位置決めが正確に行われる。当接面９７と上記図示しない突起の当接面とによって規定される平面（図示の例では垂直面）が合体面であり、その合体面に直角な方向が合体方向である。なお、係合装置６８が係合突起７０を基台１０側に引き付ける際の引付力は、回動可能車輪８８を床から、ローラ８４をガイドレール９２からそれぞれ離れさせるために必要な力よりも更に大きくされており、台車５２と基台１０との合体が強固になされる（例えば、各係合装置６８毎に約２５０kgf ≒２４５０N程度の大きさとされる）。

【００５４】フィーダ５４は、フィーダ保持装置６４に設けられる複数のフィーダ保持ユニット１００により、各々１つずつ保持される。本実施形態の台車５２においては、フィーダ保持装置６４の本体部材（後述のベースプレート１０６）によりフィーダ保持部材が構成され、フィーダ保持ユニット１００によりフィーダ保持部が構成されているのである。本フィーダ保持装置６４は、隣接する６つのフィーダ保持ユニット１００からなるフィーダ保持ユニット群１０２を４つ備えている（図７には、１つのフィーダ保持ユニット群１０２のうちの１つのフィーダ保持ユニット１００のみが図示されている）。したがって、本フィーダ保持装置６４は、最大２４個のフィーダ５４を保持することができる。

【００５５】図７に示すように、フィーダ保持ユニット１００は、ベースプレート１０６と、そのベースプレート１０６に支持された係合部材１０８およびガイドプレート１１０と、フィーダ５４に圧縮空気を供給する空気供給部１１２と、フィーダ５４に各種の電力を供給する

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電力供給部１１４とを有している。ベースプレート１０６とガイドプレート１１０とは、すべてのフィーダ保持ユニット１００に共有され、係合部材１０８は、各フィーダ保持ユニット群１０２を構成する６つのフィーダ保持ユニット１００に共有される。

【００５６】ベースプレート１０６には、基台１０と台車５２とが並ぶ方向に平行に延びる複数の係合溝（図示省略）が各フィーダ保持ユニット１００に対応して設けられている。各フィーダ５４は、その係合溝と係合部材１０８とに係合可能な係合突起１２２を備えている。各フィーダ５４がフィーダ保持ユニット１００に保持される際には、図７において、右から左へ平行移動させられて、最終的に図７に示す位置に保持される。フィーダ保持ユニット１００に保持されたフィーダ５４は、自身の係合突起１２２とベースプレート１０６の係合溝との係合により、図７の紙面と直交する方向の相対移動が禁止される。また、複数の支柱１２４によりベースプレート１０６に取り付けられたガイドプレート１１０によって、図７の紙面と平行な平面内における上下方向の移動はわずかな量に限定される。このことにより、フィーダ保持ユニット１００への着脱の際の、係合突起１２２と係合部材１０８との係合・離脱は、滑らかに行われ得る。そして、図７に示す状態では、係合部材１０８と係合突起１２２との係合によって、フィーダ５４がベースプレート１０６に対して垂直方向に移動することが禁じられる。

【００５７】フィーダ５４には、ベースプレート１０６に設けられる係合溝１２５との係合により、フィーダ５４自身をフレーム６２に向かう向き（図７において左向き）に付勢するＵ字形の係合部材１２６が設けられている。この係合部材１２６は、レバー１２８が操作されなければ、図７に示すようにフィーダ５４の外部に突出させられているが、レバー１２８が操作されている間は、フィーダ５４の内部に収納される。係合部材１２６をフィーダ５４内へ収納する機構は、図１０を用いて後に説明する。フィーダ５４がフィーダ保持ユニット１００に保持される過程においては、係合部材１２６はフィーダ５４内に格納されるように、レバー１２８が操作されるが、レバー１２８の操作を解除すれば、フィーダ５４がフィーダ保持ユニット１００に強固に保持されることになる。フィーダ５４をフィーダ保持ユニット１００から取り外すためには、レバー１２８を操作して、係合部材１２６をフィーダ５４の内側に収納した後に、フィーダ５４を図７において右方向に平行移動させればよい。

【００５８】また、台車５２には、基台１０側から各種の電力の供給を受けるための図示しない電力被供給部と、圧縮空気の供給を受けるための空気被供給部とが設けられている。

【００５９】図７に示すように、フィーダ５４は、同一種類の回路部品を複数個収容する部品収容リール１５０

を、２つまで装着できる。部品収容リール１５０には、回路部品を収容するテープ状収容容器１５２と、そのテープ状収容容器１５２内の回路部品が脱落しないようにテープ状収容容器１５２に接着されるカバーフィルム１５４とからなる部品収容テープ１５６が巻き付けられている。部品収容テープ１５６は、テープ状収容容器１５２が、幅方向の両側において長手方向に延びる被支持部と、それら一対の被支持部の間から下方へ等間隔に突出させられた多数の容器状の回路部品収容部とを有するエンボスタイプのテープである。テープ状収容容器１５２に接着されているカバーフィルム１５４は、部品吸着ノズル７８４により回路部品が吸着される位置（図８において部品吸着ノズル７８４が示されている位置である。この位置は部品供給位置であって、部品取出位置であり、以下、部品取出位置と称する）よりもわずかに部品収容リール１５０側（図７において右側）においてテープ状収容容器１５２から剥がされる。回路部品の供給を終えたテープ状収容容器１５２は、回路部品装着装置１８側（図７において左側）に送られる。この送りのピッチは、テープ状収容容器１５２の長手方向における回路部品の保持ピッチと一致させられる。

【００６０】回路部品の供給を終えたテープ状収容容器１５２は、テープガイド１６０によりテープを切断する切断手段たる切断機１６２に導かれる。これらテープガイド１６０と切断機１６２とは、フレーム６２に取り付けられている。切断機１６２は、テープ状収容容器１５２を切断し、切断されたテープ状収容容器１５２の切断片は、フレーム６２の下部に取り付けられた切断片収容器１６４に収容される。なお、テープ状収容容器１５２から剥がされたカバーフィルム１５４の処理については後述する。テープガイド１６０と切断機１６２とは、図７において想像線（二点鎖線）により表されている。

【００６１】次に、フィーダ５４の構成を説明する。図９はフィーダ５４の側面図である。フィーダ５４は、同一種類の回路部品を複数個収容する部品収容リール１５０を、上述のように２つまで装着できる。フィーダ５４は、制御装置１０５０（図２４参照）からの供給命令に基づいて、１つまたは２つの部品収容リール１５０に収容されている１種類または２種類の回路部品を、１つずつ独立に供給できる。２つの部品収容リール１５０の回路部品を同時に供給することも可能である。ただし、回路部品装着装置１８は、後述するように部品吸着ノズル７８４を複数有しているが、それら複数の部品吸着ノズル７８４は１つずつ回路部品の吸着を行い、複数が同時に回路部品を吸着することはなく、回路部品を同時に供給する要求は通常は発生しない。したがって、複数のフィーダ５４が同時に供給命令を受け取ることもない。

【００６２】図１０は、フィーダ５４の一部を拡大して示す正面図である。なお、図１０は、第１カバー１９２，第２カバー１９４，第３カバー１９６（図９参照）が取り外された状態を示している。フィーダ５４は、２つまでの部品収容リール１５０に巻き付けられた部品収容テープ１５６に収容された回路部品を供給するために、側板１９８に取り付けられた２つの駆動装置２００，２０１を備えている。

【００６３】一方の駆動装置２００は、モータ２０２と、そのモータ２０２の回転軸に取り付けられる駆動ギヤ２０４と、その駆動ギヤ２０４と噛み合わされる駆動ギヤ２０４よりも歯数が多い被駆動ギヤ２０６と、その被駆動ギヤ２０６と一体的に形成される駆動プーリ２０８と、その駆動プーリ２０８の回転力を伝達する駆動ベルト２１０と、その駆動ベルト２１０により駆動される被駆動プーリ２１２と、その被駆動プーリ２１２と一体的に形成されるスプロケット２１４とを備えている。また、駆動プーリ２０８の回転を伝達する駆動ベルト２１６と、その駆動ベルト２１６により駆動される被駆動プーリ２１８と、その被駆動プーリ２１８と一体的に形成される駆動側のピンチローラ２２０と、ピンチローラ２２０の外周面に予め設定された接触圧で接触させられる遊動側のピンチローラ２２２とを含んでいる。つまり、モータ２０２の回転は、スプロケット２１４と、ピンチローラ２２０およびピンチローラ２２２とに伝達される。

【００６４】駆動ベルト２１０は、複数のガイドローラ２２４により、通過経路を規定されている。また、モータ２０２はパルスモータであるので、スプロケット２１４の回転角度は、モータ２０２に与えられるパルスの数によって制御可能である。なお、モータ２０２とスプロケット２１４との回転角度は、駆動ギヤ２０４と被駆動ギヤ２０６とのギヤ比と、駆動プーリ２０８と被駆動プーリ２１２との半径の比との積と同じ比率で異なる。テープ状収容容器１５２には、その長手方向に一定間隔で連なる係合穴が形成されており、スプロケット２１４の外周上に等間隔に形成される突起と係合させられる。その係合を確実にするために、テープ状収容容器１５２のスプロケット２１４からの浮上がりがカバー２２５によって防止されている。

【００６５】スプロケット２１４が回転すると、部品収容リール１５０が回転させられる際の摩擦抵抗やガイドローラ２２４の回転摩擦等に起因する張力が、部品収容テープ１５６に発生する。本フィーダ５４においては、モータ２０２に与えるパルスの数を変更することにより、そのような外乱要因の大小に係わらず、容易に任意の送り量で部品収容テープ１５６を送ることができる。したがって、部品収容テープ１５６において回路部品が収容されているピッチが変わっても、容易に対処できる。ピンチローラ２２０と２２２とは、予め設定された接触圧で接触しており、図９に示すように、それらの間に部品収容テープ１５６から剥がされたカバーフィルム１５４が挟み込まれる。

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【００６６】ピンチローラ２２０と２２２とは、部品収容テープ１５６がスプロケット２１４によって送られる際に、カバーフィルム１５４の既に剥がされている部分を部品収容リール１５０側に送ることによって、部品収容テープ１５６に接着されているカバーフィルム１５４を、順次剥がす機能を果たすのである。このカバーフィルム１５４の送り量は、スプロケット２１４による部品収容テープ１５６の送り量より大きくなるようにされている。そして、カバーフィルム１５４の部品収容テープ１５６からの剥離位置は、カバー２２５に形成されたカバーフィルム１５４の引出しスリットにより規定されているため、カバーフィルム１５４の送り量の過大分は、ピンチローラ２２０，２２２のカバーフィルム１５４に対するすべりにより吸収され、カバー２２５とピンチローラ２２０，２２２との間のカバーフィルム１５４は常に緊張状態に保たれる。

【００６７】他方の駆動装置２０１も同様に、モータ２２６，駆動ギヤ２２８，被駆動ギヤ２３０，駆動プーリ２３２，駆動ベルト２３４，２３６，被駆動プーリ２３８，ピンチローラ２４０，２４２，ガイドローラ２４４等により構成されている。なお、本駆動装置２０１にも、上述のスプロケット２１４および被駆動プーリ２１２と同様のものが、図１０においてそれらに重なりあう位置に設けられている。

【００６８】ピンチローラ２２０，２２２と、ピンチローラ２４０，２４２とによってそれぞれ送られるカバーフィルム１５４は、図９に示すように、軸方向が図９において上下方向とされた状態で取り付けられるパイプ２４６内を通過して下方に落とされる。したがって、フィーダ５４がフィーダ保持ユニット１００に保持されている状態では、廃棄されるべきカバーフィルム１５４が、台車５２のベース６０上に溜められることとなる。また、パイプ２４６内におけるカバーフィルム１５４の通過を滑らかにするために、空気ノズル２４８が設けられており、モータ２０２とモータ２２６との少なくとも一方が回転させられる際に、圧縮空気がパイプ２４６内に上方から下方に向けて吹き込まれるようにされている。空気ノズル２４８への圧縮空気の供給は、ソレノイドバルブ２５０が開かれることによってなされる。

【００６９】フィーダ５４には、図示しないいくつかの操作スイッチが設けられている。これらの操作スイッチには、モータ２０２とモータ２２６とをそれぞれ独立に正逆両方向に回転させるためのもの、回路部品の供給の際の各モータの回転速度を決定するためのもの、回路部品を１つ供給するごとの各モータの回転角度を決定するためのもの、駆動装置２００および２０１をそれぞれ作動させるか否かを決定するためのもの等が含まれている。

【００７０】フィーダ５４のレバー１２８は、図１０に示すように、付勢部材たるスプリング２５２により、支

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点２５４を中心に図１０において左回りに回動する向きに付勢されている。この付勢力は、リンク機構２５６により係合部材１２６に伝達され、レバー１２８が操作されていない状態では、係合部材１２６がフィーダ５４の外部に突出させられる。係合部材１２６をフィーダ５４の内部に収納させるには、レバー１２８を支点２５４を回転中心として、図１０において右回りに回動させる。

【００７１】フィーダ５４は、フィーダ保持ユニット１００の空気供給部１１２と嵌合して、前述のソレノイドバルブ２５０に圧縮空気を供給するための空気被供給部２７２を備えている。さらに、電力供給部１１４と電気的に接続されてモータ２０２等に電力を供給するための電力被供給部２７４も備えている。この電力は、基台１０側から台車５２に供給される。なお、台車５２と基台１０とが合体していない場合に、電力の供給を受けるための図示しない第２の電力被供給部が、台車５２に設けられている。回路部品の装着作業に先立って行われる準備作業において、基台１０と台車５２とが合体されていない状態では、この第２の電力被供給部から供給される電力が使用される。

【００７２】回路部品装着装置１８，２０を説明する。図１に示すように、回路部品装着装置１８，２０はいずれも、装着ヘッド６５０，６５２と、Ｘ軸スライド６５４，６５６およびＹ軸スライド６５８，６６０を備えて装着ヘッド６５０，６５２を水平面内の任意の位置へ移動させるＸＹロボット６６２，６６４とを有している。これら装着ヘッド６５０，６５２の構成は同じであり、ＸＹロボット６６２，６６４の構成は同じであり、回路部品装着装置１８の装着ヘッド６５０およびＸＹロボット６６２を代表的に説明する。

【００７３】前記基台１０上の基板搬送方向（Ｘ軸方向）に隔たった２箇所にはそれぞれ、図２および図３に示すように、案内部材たる直線状のガイドレール６６６がＹ軸方向に平行に設けられるとともに、Ｙ軸スライド６５８が移動可能に嵌合されている。Ｙ軸スライド６５８は前記フィーダ５４が取り付けられる台車５２のＸ軸方向の寸法より長く、長手方向の両端部にそれぞれ被案内部材たる２個ずつのガイドブロック６６８（図２，図３参照）が固定されるとともに、ガイドレール６６６に移動可能に嵌合されている。

【００７４】Ｙ軸スライド６５８には、図２および図３に示すように、一対のガイドレール６６６に嵌合された部分の上側の部分にそれぞれナット６７０がＹ軸方向に平行に固定されるとともに、基台１０にＹ軸方向に平行な軸線まわりに回転可能に取り付けられたねじ軸６７２に螺合されている。これらナット６７０およびねじ軸６７２はボールねじを構成している。基台１０のＸ軸方向に隔たった２箇所にはそれぞれ、２本ずつのねじ軸６７２が上下に設けられており、Ｙ軸スライド６５８は、Ｘ軸方向の一端部と他端部とにおいて上下の位置が異なる

ねじ軸６７２に螺合されている。なお、Ｙ軸スライド６５８には、自身が螺合されるのではないねじ軸６７２との干渉を回避するために貫通孔（図示省略）が設けられている。

【００７５】４本のねじ軸６７２はそれぞれ、基台１０上に設けられた駆動源たるＹ軸サーボモータ６７４により回転させられる。Ｙ軸サーボモータ６７４は交流サーボモータであり、Ｙ軸スライド６５８を駆動する２個のＹ軸サーボモータ６７４は駆動回路を共通にして同期して回転させられる。そのため、Ｙ軸スライド６５８は長手形状を有するが、Ｙ軸スライド６５８や、Ｙ軸スライド６５８に搭載されているＸ軸スライド６５４，装着ヘッド６５０等の慣性に基づくこじりや振動を生ずることなく、高速で移動させることができる。一対のガイドレール６６６は、回路部品装着装置１８，２０の各Ｙ軸スライド６５８，６６０に共通であるが、Ｙ軸スライド６５８，６６０は個別に駆動され、干渉することはない。

【００７６】Ｙ軸スライド６５８の下面には、図１および図３に示すように、案内部材たる直線状の２本のガイドレール６７６がＸ軸方向に平行に固定されるとともに、Ｘ軸スライド６５４に固定された被案内部材たるガイドブロック６８０が移動可能に嵌合されている。Ｘ軸スライド６５４の上面には、図３に示すようにブラケット６８２によってナット６８４が固定されるとともに、Ｙ軸スライド６５８にＸ軸方向に平行に配設され、回転可能かつ軸方向に移動不能に取り付けられたねじ軸６８６に螺合されており、ねじ軸６８６が駆動源たるＸ軸サーボモータ６８８（図２参照）によって回転させられることにより、Ｘ軸スライド６５４がＸ軸方向に移動させられる。これらナット６８４およびねじ軸６８６はボールねじを構成している。なお、符号６９０，６９２（図１および図２参照）はフレキシブル配線・配管等保護具であり、保護具６９０は、基台１０とＹ軸スライド６５８との間に設けられた信号伝達線，給電線，エア供給ホース，負圧供給ホース等を保護し、保護具６９２は、Ｙ軸スライド６５８とＸ軸スライド６５４との間に設けられた信号伝達線等を保護する。なお、保護具６９０は図１のみに図示され、保護具６９２は図２のみに図示されている。

【００７７】装着ヘッド６５０はＸ軸スライド６５４に搭載されている。Ｘ軸スライド６５４は、図１１に示すように、前記ガイドブロック６８０が固定されてＹ軸スライド６５８により吊下げ状態で支持された被支持部７００と、被支持部７００のＸ軸方向の一端部から下方へ垂下させられた連結部７０２とを有する。連結部７０２の下端部には、図１１および図１３に示すように、被支持部７００のＸ軸方向の他端部側へ水平に突出させられた取付部７０４が設けられるとともに、取付部７０４のＹ軸方向の中央部は、連結部７０２とは反対側へ水平に突出させられて支持部７０６とされている。

【００７８】支持部７０６は、図１１に示すように、回転軸７０８の下端部を軸受７１０を介して回転可能に支持しており、回転軸７０８の上端部は、被支持部７００により回転可能に支持されている。被支持部７００には固定カム７１２が固定されている。固定カム７１２には、嵌合穴７１３が回転軸７０８と同心にかつ固定カム７１２を貫通して形成されるとともに、軸受７１４を介して駆動歯車７１６の被支持部７１８が回転可能に嵌合されている。被支持部７１８の固定カム７１２から突出した上端部には被駆動プーリ７２２が同心に固定され、一体的に回転するようにされるとともに、これら駆動歯車７１６および被駆動プーリ７２２は、軸受７２０，７２１を介して回転軸７０８を回転可能に支持している。回転軸７０８は、水平な搬送平面に対する垂線と平行な軸線（垂直線である）まわりに回転可能に設けられ、駆動歯車７１６および被駆動プーリ７２２は回転軸７０８と同心に設けられているのである。

【００７９】上記被駆動プーリ７２２には、図１４に示すように、駆動源たる方位補正変更用サーボモータ７２４の回転が駆動プーリ７２６および巻きかけ部材たるタイミングベルト７２８によって伝達され、駆動歯車７１６が正逆両方向に任意の角度回転させられる。被駆動プーリ７２２には、図１１に示すように、板状の被検出体７３０が半径方向外向きに固定されており、この被検出体７３０をＸ軸スライド６５４に固定された駆動歯車原位置センサ７３２（図１４参照）が検出することにより、駆動歯車７１６の原位置が検出される。駆動歯車７１６の原位置は電源投入時に検出され、それに基づいて駆動歯車７１６の回転位置が演算される。

【００８０】回転軸７０８の上端部には、被駆動回転体たる被駆動プーリ７４０が同心に固定されている。被駆動プーリ７４０には、図１４に示すように、駆動源たる旋回用サーボモータ７４２の回転が駆動プーリ７４４および巻きかけ部材たるタイミングベルト７４６により伝達され、回転軸７０８は旋回用サーボモータ７４２により正逆両方向に任意の角度回転させられる。被駆動プーリ７４０には、図１１に示すように、板状の被検出体７４８が半径方向外向きに固定されており、この被検出体７４８がＸ軸スライド６５４に固定された回転軸原位置センサ７５０（図１４参照）によって検出されることにより、回転軸７０８の原位置がわかる。電源投入時に回転軸７０８の原位置が検出され、それに基づいて回転軸７０８の回転位置が演算される。

【００８１】回転軸７０８の駆動歯車７１６により支持された部分の下側には、部品吸着軸保持部材７６０が同心に固定され、回転軸７０８と共に間欠回転体７６２を構成している。部品吸着軸保持部材７６０は概して円筒状を成し、その周壁の回転軸線を中心とする一円周上には、回転軸線に平行な方向に貫通する保持穴７６４が２０個、等角度間隔に形成されている。各保持穴７６４に

はそれぞれ、部品吸着軸７６６を構成する軸部たる軸部材７６８が軸受７７０および保持部材７７２を介して回転可能かつ軸方向に移動可能に嵌合されており、間欠回転体７６２の回転時に２０個の部品吸着軸７６６が間欠回転体７６２の回転軸線を中心として旋回させられる。

【００８２】保持穴７６４の直径は軸部材７６８の直径より大きく、図１２に示すように、軸部材７６８は２個のシール部材７７４，７７６により気密が保持されて保持穴７６４に嵌合され、保持穴７６４内に円環状の通路７８０が形成されている。上記保持部材７７２は、保持穴７６４の下側開口部に嵌合されるとともに、図示しない固定手段たるボルトによって部品吸着軸保持部材７６０に固定されており、一方のシール部材７７６は保持部材７７２により保持されている。軸受７７０および保持部材７７２は部品吸着軸保持部材７６０に相対移動不能に取り付けられて間欠回転体７６２の一部を構成しており、保持穴７６４の軸受７７０が取り付けられた部分および保持部材７７２内に設けられて軸部材７６８が嵌合される穴が、軸部材７６８が回転可能かつ軸方向に移動可能に嵌合される保持穴を構成している。

【００８３】部品吸着軸７６６の軸部材７６８の下端部は部品吸着軸保持部材７６０から下方へ突出させられており、ノズル嵌合穴７８２が同心に形成されるとともに、部品吸着ノズル７８４が軸方向に相対移動可能に嵌合されている。部品吸着ノズル７８４は、吸着管保持体７８６と、吸着管保持体７８６により保持された吸着管７８８とを有し、付勢手段の一種である弾性部材としての圧縮コイルスプリング７９０によりノズル嵌合穴７８２から突出する向きに付勢されている。部品吸着ノズル７８４のノズル嵌合穴７８２からの抜出しおよび軸部材７６８に対する回転は、吸着管保持体７８６に嵌合された係合部材たるピン７９２が、ノズル嵌合穴７８２の周壁に形成された係合凹部たる切欠７９４に係合することにより防止されている。７９６は、吸着管保持体７８６に設けられた反射板である。ここでは説明を容易にするために、２０個の部品吸着ノズル７８４はいずれも同じ種類のものであり、吸着管７８８の径は同じであるとする。部品吸着ノズル７８４は、回路部品の種類に適したものが選択されて軸部材７６８に取り付けられるが、部品吸着ノズル７８４が吸着し得る回路部品は１種類に限らず、大きさが異なる複数種類の回路部品を吸着することが可能である。

【００８４】軸部材７６８の上端部は、部品吸着軸保持部材７６０から上方へ突出させられるとともに、突出端部には被駆動歯車８００およびカムフォロワ保持体８０２が同心に固定されている。被駆動歯車８００は、前記駆動歯車７１６より径が小さく、駆動歯車７１６に噛み合わされており、駆動歯車７１６が回転させられることにより、駆動歯車７１６に噛み合わされた全部の被駆動歯車８００が一斉に回転させられ、２０個の部品吸着軸７６６が一斉に同角度、同方向に回転させられる。

【００８５】カムフォロワ保持体８０２は、内部に球状のカムフォロワ８０４をあらゆる方向に回転可能かつ抜出し不能に保持しており、カムフォロワ８０４の一部はカムフォロワ保持体８０２から上方へ突出させられている。部品吸着軸７６６は、前記通路７８０内に配設された付勢手段の一種である弾性部材としての圧縮コイルスプリング８０６により上方へ付勢され、カムフォロワ８０４が前記固定カム７１２のカム面８０８に当接させられている。圧縮コイルスプリング８０６の一端部は、軸部材７６８に固定のばね受け８１０により受けられ、他端部はリテーナにより保持されるとともに、前記保持部材７７２に取り付けられた軸受８１２により、保持部材７７２に対して回転可能に支持されている。そのため、部品吸着軸７６６が自身の軸線のまわりに回転させられるとき、圧縮コイルスプリング８０６が共に回転し、ねじりが生ずることがない。部品吸着軸７６６の軸部材７６８は軸受８１２を貫通させられ、軸受８１２に対して軸方向に移動可能かつ回転可能である。

【００８６】固定カム７１２は、図１１および図１２に示すように、回転軸７０８と同心の円筒状のカム面構成部８１４を有し、カム面構成部８１４の下面が前記カム面８０８とされている。カム面８０８は、部品吸着軸７６６の旋回軌跡の上方に設けられ、図１１および図１５に示すように、一部の高さが変化させられている。そのため、間欠回転体７６２が回転させられるとき、カムフォロワ８０４がカム面８０８に沿って転がりつつ移動させられ、２０個の部品吸着軸７６６は回転軸７０８の軸線のまわりに旋回させられつつ昇降させられる。

【００８７】間欠回転体７６２が回転させられ、部品吸着軸７６６が旋回しつつ昇降するとき、２０個の部品吸着軸７６６の各軸部材７６８の上端部に固定された前記被駆動歯車８００はそれぞれ、駆動歯車７１６とかみ合った状態を保って昇降させられる。駆動歯車７１６は被駆動歯車８００より幅が広く、すなわち間欠回転体７６２の回転軸線に平行な方向であって、部品吸着軸７６６の軸方向に平行な方向の寸法が長く、部品吸着軸７６６が昇降させられても、被駆動歯車８００は駆動歯車７１６に噛み合った状態に保たれる。

【００８８】また、Ｘ軸スライド６５４の取付部７０４には、間欠回転体７６２の回転軸線を中心とする部分円筒面に沿って切欠８１６（図１１および図１３参照）が形成され、部品吸着軸７６６およびそれに保持された回路部品との干渉が回避されるようになっている。

【００８９】カム面８０８は、最も低い位置から正方向および逆方向に向かうに従って高くなり、いずれの方向においても９０度離れた位置において最も高くなるように形成されている。２０個の部品吸着軸７６６は、回転軸７０８が部品吸着軸７６６の配設角度間欠に等しい角度、間欠回転させられることにより、２０個の停止位置

に停止させられる。これら２０個の停止位置のうち、カム面８０８の最も低い部分に対応する位置が部品吸着装着位置（部品受取装着位置，部品吸着解放位置とも称し得る）とされ、部品吸着装着位置から９０度離れた位置であって、カム面８０８の最も高い部分に対応する位置が撮像位置とされている。カム面８０８は、部品吸着装着位置および撮像位置の各前後においては部品吸着軸７６６が水平に移動するように形成されている。部品吸着装置位置および撮像位置の設定を図１６に概略的に示す。図中、丸は部品吸着ノズル７８４の反射板７９６を表す。

【００９０】Ｘ軸スライド６５４の撮像位置に対応する位置には、回路部品撮像装置８２０が設けられている。回路部品撮像装置８２０は、図１３および図１５に示すように、Ｘ軸スライド６５４の前記取付部７０４のＹ軸方向の一端部にブラケット８２４および８２６によって取り付けられている。ブラケット８２４は取付部７０４にねじ部材８２８および長穴８３０によってＸ軸方向の位置調節可能に固定され、ブラケット８２６はブラケット８２４に、ねじ部材８３２および長穴８３４によってＹ軸方向の位置調節可能に固定されている。

【００９１】回路部品撮像装置８２０は、照明装置８３６，反射装置８３８およびＣＣＤカメラ８４０を備えている。照明装置８３６および反射装置８３８は、図１５に示すように、撮像位置に停止させられた部品吸着軸７６６および部品吸着軸７６６に保持された回路部品８４２の下側において、撮像位置に位置する部品吸着軸７６６の旋回軌跡に対する接線および間欠回転体７６２の回転軸線に対して直角に延び、かつ回路部品８４２と対向する状態で設けられている。反射装置８３８は、例えばプリズムあるいは複数のミラーを有し、像形成光の方向を変換してＣＣＤカメラ８４０に入光させる。照明装置８３６は、反射装置８３８の両側にそれぞれ設けられた照明部８４８を有し、部品吸着ノズル７８４の反射板７９６に向かって光を照射する。回路部品撮像装置８２０の水平方向の位置は、ブラケット８２４，８２６の取付位置の調節により調節し得る。また、照明装置８３６は、操作部材８５０を操作することにより取り外すことができる。

【００９２】このように撮像位置は部品吸着装着位置より高くされ、固定カム７１２およびカムフォロワ８０４によって部品吸着軸７６６が上昇させられることによって形成された隙間に回路部品撮像装置８２０が配設されており、回路部品撮像装置８２０と部品吸着ノズル７８４およびそれに保持された回路部品８１４との干渉、ならびに回路部品撮像装置８２０と回路部品供給装置１４およびプリント基板４０８との干渉を回避しつつ、部品吸着および装着のための部品吸着ノズル７８４の昇降距離を小さくすることができる。部品吸着装着位置と撮像位置とにおける部品吸着軸７６６の高さが同じであれば、回路部品撮像装置８２０と回路部品供給装置１４およびプリント基板４０８との干渉を回避しなければならないことは勿論、回路部品撮像装置８２０と部品吸着軸７６６およびそれに保持された回路部品８１４との干渉を回避しなければならず、部品吸着装着位置における部品吸着軸７６６の位置が高くなって部品吸着および装着のための昇降距離が長くなるのに対し、固定カム７１２およびカムフォロワ８０４によって部品吸着軸７６６を上昇させれば、それによって回路部品撮像装置８２０との干渉を回避することができ、部品吸着装着位置における部品吸着軸７６６の高さを低くすることができ、昇降距離を短くすることができるのである。

【００９３】Ｘ軸スライド６５４にはまた、図１１に示すように、プリント基板４０８に設けられた基準マークを撮像する基準マーク撮像装置８５４が搭載されている。基準マーク撮像装置８５４は、Ｘ軸スライド６５４の連結部７０２のＹ軸方向において回路部品撮像装置８２０が取り付けられた部分とは反対側の下部に下向きに取り付けられている。

【００９４】前記部品吸着ノズル７８４は負圧により回路部品８４２を吸着するものであり、部品吸着軸保持部材７６０の外面には、２０個の部品吸着軸７６６の各々について圧力切換弁８６０が等角度間隔に固定されている（図１５には２個のみ代表的に図示されている）。部品吸着軸７６６内には、図１２に示すように軸方向に延び、ノズル嵌合穴７８２に連通する通路８６２が形成され、通路８６２は保持穴７６４と部品吸着軸７６６との間に形成された前記通路７８０，部品吸着軸保持部材７６０内に形成された図示しない通路により圧力切換弁８６０に接続されている。

【００９５】負圧は、図１１に示すように、前記Ｘ軸スライド６５４の取付部７０４および支持部７０６内に形成された通路８６６，円環状通路８６８，回転軸７０８内に形成された通路８７０および図示しないホース等により１２個の圧力切換弁８６０の各々に供給される。通路８６６は、Ｘ軸スライド６５４に継手部材により取り付けられた図示しないホース等を経て真空装置に接続されている。通路８７０は円環状通路８６８により、回転軸７０８が回転しても常時通路８６６に連通した状態に保たれる。

【００９６】圧力切換弁８６０は、図１２に示すように、ハウジング８７２内に上下方向に直線移動可能（昇降可能）に配設された切換部材８７４を備えており、部品吸着ノズル７８４内の圧力を負圧と大気圧以上の圧力とに切り換える。切換部材８７４は下方への移動により負圧供給位置へ移動させられ、圧力切換弁８６０が部品吸着ノズル７８４内の圧力を大気圧以上の圧力から負圧に切り換え、部品吸着ノズル７８４に回路部品８４２を吸着させる。圧力切換弁８６０のこの切換状態を負圧供給状態と称する。切換部材８７４はまた、上方への移動

により負圧解除位置へ移動させられ、圧力切換弁８６０が部品吸着ノズル７８４内の圧力を負圧から大気圧以上の圧力に切り換え、部品吸着ノズル７８４に回路部品８４２を解放させる。圧力切換弁８６０のこの切換状態を負圧解除状態と称する。切換部材８７４の移動方向（軸方向）の両端部にはそれぞれ大径のストッパ部８７６，８７８が設けられており、負圧供給位置および負圧解除位置で切換部材８７４の移動を阻止する。切換部材８７４はまた、負圧供給位置および負圧解除位置へ移動させられた状態では、各位置に保たれるように構成されている。

【００９７】Ｘ軸スライド６５４の部品吸着装着位置の近傍部には、図１７ないし図１９に示すように、部品吸着軸７６６を昇降させる個別昇降装置８８０および切換弁制御装置８８２の機構部が設けられている。Ｘ軸スライド６５４の部品吸着装着位置に対応する部分には、図１７および図１９に示すように、駆動源たるリニアモータ８８６が固定されている。リニアモータ８８６の可動子８８８は、リニアモータ８８６のハウジングから下方へ垂直に延び出させられるとともに、移動部材８９０が固定されている。

【００９８】移動部材８９０には、図２０および図２２に示すように、移動部材８９０を、部品吸着装着位置に停止させられた部品吸着軸７６６の旋回軌跡に対する接線と平行な方向に貫通する切欠８９１が形成されるとともに、昇降駆動部材８９２が部品吸着軸７６６の旋回軌跡（図２２に一点鎖線で示す）から側方へ外れた位置において、軸８９４により垂直軸線まわりに回動可能に取り付けられている。昇降駆動部材８９２の軸８９４から固定カム７１２側へ突出させられた端部には、図１８に示すように、薄板状の昇降駆動部８９６が設けられており、前記固定カム７１２の部品吸着装着位置に対応する部分に設けられた切欠８９８（図１８および図２１参照）に昇降可能に嵌合されている。切欠８９８は、昇降駆動部８９６が隙間なく、かつ嵌合，離脱可能に嵌合される幅（固定カム７１２の周方向の寸法）と、昇降駆動部８９６の厚さより僅かに大きく、カムフォロワ８０４が嵌入しても通過可能な深さ（固定カム７１２の中心線に平行な方向の寸法）とを有する。

【００９９】昇降駆動部材８９２は、リニアモータ８８６により移動部材８９０が昇降させられることにより昇降させられ、移動部材８９０が上昇端位置へ移動させられ、昇降駆動部８９６が切欠８９８に昇降可能に嵌合されて、その下面が固定カム７１２のカム面８０８と連続する上昇位置と、移動部材８９０が下降させられ、昇降駆動部８９６が切欠８９８から外れて、下面がカム面８０８より下方に位置する下降位置との間で昇降させられる。なお、図示は省略するが、昇降駆動部８９６の上面の部品吸着軸旋回方向に隔たった両縁部は斜めに切り欠かれ、昇降駆動部８９６の切欠８９８への嵌合を案内する案内部が設けられている。

【０１００】昇降駆動部材８９２の昇降駆動部８９６が設けられた側とは反対側の端部の下面には、図２０に示すように、昇降駆動部材８９２の長手方向に延び、昇降駆動部材８９２の回動軸線と直交する位置決め凹部たるノッチ９００が形成されている。前記移動部材８９０には、ボールスプリングと称される位置決め具９０２が取り付けられている。位置決め具９０２は、移動部材８９０に螺合されたケーシング９０６内に位置決め部材たるボール９０８が移動可能かつ抜出し不能に収容されるとともに、ケーシング９０６内に収容された付勢手段の一種である弾性部材としてのスプリングにより、ケーシング９０６から突出する向きに付勢されている。

【０１０１】移動部材８９０にはまた、図２１および図２２に示すように、ブラケット９１２が固定されるとともに、位置調節可能なストッパ部材たるアジャストボルト９１４が螺合されている。アジャストボルト９１４は、昇降駆動部材８９２の昇降駆動部８９６が設けられた側とは反対の端部側であって、図２２に矢印で示す部品吸着軸７６６の旋回方向に対して昇降駆動部材８９２より下流側に設けられている。このアジャストボルト９１４は、昇降駆動部材８９２の回動軸線に直角で、部品吸着装着位置における部品吸着軸７６６の旋回軌跡に対する接線に平行な向きに螺合され、昇降駆動部材８９２の誤作動により下降位置にあって部品吸着軸７６６により回動させられる際の回動方向とは逆の方向への回動限度を規定する。

【０１０２】アジャストボルト９１４の先端の位置は、昇降駆動部材８９２がアジャストボルト９１４に当接した状態でボール９０８がノッチ９００に嵌入するとともに、ノッチ９００のアジャストボルト９１４側の傾斜した側面に係合し、他方の側面から離れて、上記側面の斜面の作用により昇降駆動部材８９６をアジャストボルト９１４に押し付け、昇降駆動部８９６を、固定カム７１２に形成された切欠８９８に嵌合可能な作用位置（図２２に実線で示す位置）に精度良く位置決めするように調節される。ノッチ９００および位置決め具９０２が付勢手段を構成するとともに、アジャストボルト９１４と共にクリップストップ装置の一種である位置決め装置を構成している。

【０１０３】Ｘ軸スライド６５４には、昇降駆動部材８９２が図２２に二点鎖線で示すように退避位置へ回動したことを検知する移動検知装置９２０（図２４参照）が設けられている。移動検知装置９２０は発光部および受光部を有する透過型の光電センサにより構成されており、昇降駆動部材８９２の昇降駆動部８９６によって受光部の受光が妨げられることにより、昇降駆動部材８９２が退避位置へ回動したことが検出される。移動検知装置９２０は、透過型の光電センサに限らず、反射型の光電センサや、近接スイッチ，リミットスイッチ等により

構成してもよい。

【０１０４】前記移動部材８９０には、図１９ないし図２１に示すように、主エアシリンダ９３０が上下方向の位置調節可能に取り付けられている。主エアシリンダ９３０は、移動部材８９０に螺合されたアジャストボルト９３２に当接して移動部材８９０に対する上下方向の位置を決められ、その状態でシリンダチューブ９３４（図２３参照）と一体的に設けられた被取付部９３６（図２１参照）の長穴９３８を通ってボルト９４０が移動部材８９０に螺合されることにより、移動部材８９０に固定されている。

【０１０５】主エアシリンダ９３０は、流体圧シリンダの一種であるエアシリンダにより構成されている。主エアシリンダ９３０は複動シリンダであり、図２３に示すように、ピストン９４４はシリンダチューブ９３４に気密にかつ軸方向に移動可能に嵌合され、ピストンロッド９４６はシリンダチューブ９３４から下方へ突出させられている。これらピストン９４４およびピストンロッド９４６内には、軸方向に貫通する段付状の貫通穴９４８が形成されており、大径穴部９５０には作用部材９５２の嵌合部９５４が軸方向に移動可能に嵌合されている。

【０１０６】嵌合部９５４に突設された軸部９５６は小径穴部９５８を通ってピストンロッド９４６から下方へ突出させられるとともに、大形の作用部９６０が設けられている。作用部材９５２は、大径穴部９５０内に配設された付勢手段の一種である弾性部材としての圧縮コイルスプリング９６２により下方へ、すなわちピストンロッド９４６から突出する向きに付勢されている。圧縮コイルスプリング９６２の付勢による作用部材９５２の下方への移動限度は、嵌合部９５４が大径穴部９５０の底面に係合することにより規定される。また、圧縮コイルスプリング９６２の一端部は、大径穴部９５０の開口部に螺合されたプラグ９６４により受けられている。主エアシリンダ９３０は、部品吸着装着位置に停止させられた部品吸着軸７６６について設けられた圧力切換弁８６０の切換部材８７４の真上に位置する位置に設けられており、作用部材９５２は切換部材８７４の真上に位置することとなる。

【０１０７】Ｘ軸スライド６５４の部品吸着装着位置の近傍部には、図１７ないし図１９に示すように、ブラケット９７０が下方へ延び出す向きに固定されている。ブラケット９７０の垂直な側面には、案内部材たる直線状のガイドレール９７２が上下方向に設けられるとともに、流体圧シリンダの一種である主エアシリンダ９７４のシリンダチューブ９７６が被案内部材たるガイドブロック９７８において移動可能に嵌合されている。

【０１０８】主エアシリンダ９７４は複動シリンダであり、図１９に示すように、シリンダチューブ９７６内にピストン９８０が気密を保持されて移動可能に嵌合されている。ピストン９８０に突設されたピストンロッド９８２はシリンダチューブ９７６から下方へ突出させられるとともに、突出端部に別の流体圧シリンダたる補助エアシリンダ９８４が取り付けられている。ピストンロッド９８２の下端部には、雄ねじ部９８６が形成されて補助エアシリンダ９８４のシリンダチューブ９８８に螺合されており、雄ねじ部９８６の螺合量の調節により、補助エアシリンダ９８４の主エアシリンダ９７４に対する上下方向の位置を調節することができる。

【０１０９】補助エアシリンダ９８２は複動シリンダであり、シリンダチューブ９８８は被案内部材たるガイドブロック９９０において前記ガイドレール９７２に移動可能に嵌合されている。補助エアシリンダ９８４のシリンダチューブ９８８内にはピストン９９２が気密を保持されて移動可能に嵌合されており、ピストン９９２と一体的に設けられたピストンロッド９９４はシリンダチューブ９８８から下方へ突出させられるとともに、突出端部に設けられた雄ねじ部９９６には支持部材９９８が螺合されている。支持部材９９８は、被案内部材たるガイドブロック１０００においてガイドレール９７２に移動可能に嵌合されており、雄ねじ部９９６の螺合量の調節により、支持部材９９８の補助エアシリンダ９８４に対する上下方向の位置を調節することができる。

【０１１０】ガイドレール９７２の支持部材９９８が嵌合された部分より下側の部分には、作用部材１００２が被案内部材たるガイドブロック１００４において移動可能に嵌合されている。作用部材１００２と支持部材９９８との間には付勢手段の一種である弾性部材としての引張コイルスプリング１００６が設けられ、作用部材１００２は支持部材９９８に接近する向きに付勢されている。支持部材９９８の下面には、弾性材製（例えば、ゴム製）の緩衝部材１００８が固定されるとともに、作用部材１００２に形成された有底の嵌合穴１０１０に軸方向に相対移動可能に嵌合されており、引張コイルスプリング１００６の付勢力に基づく作用部材１００２の移動限度は、緩衝部材１００８が嵌合穴１０１０の底面に当接することにより規定されている。緩衝部材１００８は、作用部材１００２が引張コイルスプリング１００６の付勢力により移動させられ、その移動端位置において停止する際の衝撃を緩和する。

【０１１１】作用部材１００２は、図１７に示すように、ガイドレール９７２に嵌合された部分から間欠回転体７６２側へ水平に突出させられた後、部品吸着装着位置に停止させられた部品吸着軸７６６について設けられた圧力切換弁８６０の切換部材８７４の下方へ延び出させられている。作用部材１００２はほぼＬ字形を成すのである。作用部材１００２の切換部材８７４の真下に位置する部分には、当接部材１０１４が螺合されて作用部材１００２の作用部を構成している。当接部材１０１４の上部には、直径方向に貫通する溝１０１６が形成されている。

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【０１１２】作用部材１００２は、図１８および図１９に示すように、継手部材１０１８および図示しないエア供給ホース等を介してエア供給源（図示省略）に接続されている。エア供給源から供給されたエア（圧縮空気）は、作用部材１００２内に形成された通路１０２０および当接部材１０１６内に形成された通路１０２２を通って上方へ噴出する。継手部材１０１８とエア供給源との途中には電磁開閉弁１０２４（図２４参照）が設けられ、作用部材１００２へのエアの供給を許容，遮断するようにされている。また、継手部材１０１８には可変絞り弁１０２６が設けられ、エア供給源から作用部材１００２に供給されるエアの流量を絞るようにされている。

【０１１３】前記ブラケット９７０には、図１８および図１９に示すように、リンク１０３０が軸１０３２により、部品吸着装着位置に停止させられた部品吸着軸７６６について設けられた圧力切換弁８６０の旋回軌跡に対する接線と平行な軸線まわりに回動可能に取り付けられている。前記主エアシリンダ９７４のシリンダチューブ９７６の上部には、移動部材１０３４が一体的に設けられており、この移動部材１０３４に回転可能に取り付けられたローラ１０３６がリンク１０３０の一端部に形成された切欠１０３８（図１８参照）に回転可能に嵌合されている。

【０１１４】また、リンク１０３０の他端部に形成された切欠１０４０（図１８参照）には、前記リニアモータ８８６により昇降させられる移動部材８９０に回転可能に取り付けられたローラ１０４２（図２１参照）が回転可能に嵌合されている。したがって、移動部材８９０がリニアモータ８８６によって昇降させられれば、リンク１０３０が回動させられ、移動部材８９０と１０３４とが機械的に同期して互いに対称に昇降させられ、作用部材９５２，１００２が互いに対称に圧力切換弁８６０の切換部材８７４に接近，離間させられる。

【０１１５】本回路部品装着システム８を制御する制御装置１０５０は、図２４に示すようにコンピュータ１０５２を主体として構成される。コンピュータ１０５２は、図示しないＣＰＵ，ＲＯＭ，ＲＡＭ，それらを接続するバス，入力インタフェースおよび出力インタフェース等を有する。コンピュータ１０５２には、基板到着確認センサ５０４，減速開始位置センサ６２０，基板到着確認センサ６２２，駆動歯車原位置センサ７３２，回転軸原位置センサ７５０，回路部品撮像装置８２０，基準マーク撮像装置８５４，移動検知装置９２０等が接続されている。コンピュータ１０５２にはまた、図示しない駆動回路を介して、係合装置６８のエアシリンダを制御するエアシリンダ制御用電磁弁１０５８，モータ２０２，２２６，ロッドレスシリンダ４３６を制御するロッドレスシリンダ制御用電磁弁１０６０，基板搬送用モータ４８６，５５８，エアシリンダ６３４を制御するエアシリンダ制御用電磁弁１０６２，Ｙ軸サーボモータ６７

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４，Ｘ軸サーボモータ６８８，方位補正変更用サーボモータ７２４，旋回用サーボモータ７４２，リニアモータ８８６，主エアシリンダ９３０，９７４および補助エアシリンダ９８４をそれぞれ制御する主エアシリンダ制御用電磁弁１０６４，１０６６，補助エアシリンダ制御用電磁弁１０６８および電磁開閉弁１０２４等が接続されている。ＲＯＭには、回路部品８４２の供給，吸着，装着，プリント基板４０８の搬入，搬出等に必要な種々のプログラムが格納されている。

【０１１６】次に作動を説明する。回路部品装着装置１８，２０は、メインコンベヤ４００とメインコンベヤ４０２とのいずれか一方により位置決め支持されたプリント基板４０８に交互に回路部品８４２を装着する。１枚のプリント基板４０８について、本回路部品装着システム８において装着が予定された全部の回路部品８４２を共同して装着するのである。一方のメインコンベヤにおいて位置決め支持されたプリント基板４０８について回路部品８４２の装着が行われている間、他方のメインコンベヤにおいてはプリント基板４０８の搬出，搬入および位置決め支持が行われ、搬入されたプリント基板４０８は回路部品８４２の装着に備えてメインコンベヤ上で待機させられる。一方のメインコンベヤにおけるプリント基板４０８への回路部品８４２の装着終了後、他方のメインコンベヤにおいて待機させられているプリント基板４０８への回路部品８４２の装着が開始される。

【０１１７】まず、プリント基板４０８の搬入，位置決め支持および搬出を説明する。なお、プリント基板４０８への装着は既に開始され、定常装着状態にあるとする。プリント基板４０８は、本回路部品装着システム８の上流側に設けられたスクリーン印刷システムから搬入コンベヤ４０４へ搬入される。この搬入は、搬入コンベヤ４０４が第１シフト位置に位置する状態で行われる。搬入コンベヤ４０４が第１シフト位置に位置させられれば、基板搬送用モータ４８６が起動されるとともに、スクリーン印刷システムから搬入コンベヤ４０４へプリント基板４０８が供給される。搬入コンベヤ４０４が第１シフト位置に位置するか第２シフト位置に位置するかは、ロッドレスシリンダ４３６のピストンの移動端への移動を検出することによりわかる。搬入コンベヤ４０４へ搬入されたプリント基板４０８が基板到着確認センサ５０４により検出されれば、基板搬送用モータ４８６が止められ、プリント基板４０８は搬入コンベヤ４０４上で停止させられる。そして、搬入コンベヤ４０４がメインコンベヤ４００にプリント基板４０８を搬入するのであれば、搬入コンベヤ４０４は第１シフト位置に位置させられたままとされる。

【０１１８】なお、スクリーン印刷システムからのプリント基板４０８の供給開始後、設定時間が経過しても基板到着確認センサ５０４がプリント基板４０８を検出しない場合には、何らかの異常が発生したのであり、回路

部品８４２のプリント基板４０８への装着が中断されるとともに、異常の発生が報知される。装着の中断とは、現に行われている回路部品８４２のプリント基板４０８への装着およびプリント基板４０８の搬出の終了後、次のプリント基板４０８への回路部品８４２の装着を開始しないことである。

【０１１９】メインコンベヤ４００上のプリント基板４０８が搬出コンベヤ４０６へ搬出され（搬出については後に説明する）、メインコンベヤ４００へのプリント基板４０８の搬入が可能であれば、搬入コンベヤ４０４はメインコンベヤ４００にプリント基板４０８を搬入する。メインコンベヤ４００へのプリント基板４０８への搬入が可能であるか否かは、例えば、基板検知装置である基板到着確認センサ６２２がプリント基板４０８を検出しているか否かによりわかる。メインコンベヤ４００へのプリント基板４０８の搬入時には、基板到着確認センサ６２２の検出信号に基づいてプリント基板４０８がメインコンベヤ４００に搬入されたか否かが判定され、搬入時以外のときは、基板到着確認センサ６２２がプリント基板４０８を検出しなければ、メインコンベヤ４００上にプリント基板４０８がなく、メインコンベヤ４００にプリント基板４０８を搬入し得ることがわかる。

【０１２０】搬入時には、搬入コンベヤ４０４の基板搬送用モータ４８６およびメインコンベヤ４００，４０２の基板搬送用モータ５５８が起動され、コンベヤベルト５４６等が移動させられてプリント基板４０８がメインコンベヤ４００へ搬入される。このとき、メインコンベヤ４００に設けられた基板停止装置６２４のストッパ部材６３０は作用位置へ移動させられている。プリント基板４０８が搬入され、減速開始位置センサ６２０によって検出されれば搬送速度が減速され、基板到着確認センサ６２２によって検出されれば、基板搬送用モータ５５８が止められる。このとき、プリント基板４０８はストッパ部材６３０に当接して移動を止められており、搬送速度の減速によりプリント基板４０８はストッパ部材６３０に衝撃少なく当接する。なお、基板搬送用モータ５５８の起動後、設定時間が経過しても基板到着確認センサ６２２がプリント基板４０８を検出しない場合には、何らかの異常が発生したのであり、プリント基板４０８への回路部品８４２の装着が中断されるとともに、異常の発生が報知される。

【０１２１】基板搬送用モータ５５８の停止後、昇降台５９８が上昇させられ、基板吸着具６０２がプリント基板４０８を吸着し、支持するとともに、突上部材５８０がプリント基板４０８をコンベヤベルト５４６から持ち上げて押さえ部５７０，５７２に押し付ける。このようにプリント基板４０８はメインコンベヤ４００により位置決め支持された状態で回路部品８４２の装着に備えて待機させられる。そのため、メインコンベヤ４０２により位置決め支持されたプリント基板４０８への回路部品８４２の装着が終了すれば、最後に回路部品８４２を装着していた回路部品装着装置の退避（回路部品供給装置への移動）と並行して他方の回路部品装着装置が待機させられているプリント基板４０８上へ移動させられ、回路部品８４２の装着を開始する。プリント基板４０８の交替に要する時間が実質的に０となり、プリント基板４０８への回路部品８４２の装着が能率良く行われるのである。なお、回路部品８４２の装着については後に詳細に説明する。

【０１２２】基板搬送用モータ５５８は２つのメインコンベヤ４００，４０２に共通であり、その起動によりメインコンベヤ４００，４０２の各コンベヤベルト５４６がいずれも移動させられるが、上記のように回路部品装着時にはプリント基板４０８はコンベヤベルト５４６から持ち上げられているため、コンベヤベルト５４６の移動により送られることはなく、プリント基板４０８の回路部品８４２の装着とプリント基板４０８の搬入および後述する搬出とを並行して行うことができる。

【０１２３】回路部品８４２の装着が終了すれば、基板吸着具６０２が大気に解放され、プリント基板４０８の保持が解除される。次いで、昇降台５９８が下降させられ、プリント基板４０８がコンベヤベルト５４６上に載置された後、搬出コンベヤ４０６およびメインコンベヤ４００，４０２の各基板搬送用モータ４８６，５５８が起動され、プリント基板４０８が搬出コンベヤ４０６へ搬出される。搬出コンベヤ４０６は、メインコンベヤ４００からのプリント基板４０８の搬出時には第１シフト位置にシフトさせられている。また、ストッパ部材６３０が非作用位置へ移動させられている。

【０１２４】プリント基板４０８が搬出コンベヤ４０６へ搬出され、基板到着確認センサ５０４により検出されれば、基板搬送用モータ４８６，５５８が止められ、プリント基板４０８は搬出コンベヤ４０６上において、下流側のリフローシステムへの引渡しに備えて待機させられる。直ちに引渡しが可能であれば、搬出コンベヤ４０６の基板搬送用モータ４８６は止められず、プリント基板４０８はそのままリフローシステムに引き渡される。搬出時にも、基板搬送用モータ４８６，５５８の起動から設定時間が経過しても基板到着確認センサ５０４がプリント基板４０８を確認しなければ、異常の発生が報知されるとともに、装着が中断される。

【０１２５】搬入コンベヤ４０４は、メインコンベヤ４００にプリント基板４０８を引き渡した後、スクリーン印刷システムから次のプリント基板４０８を受け取る。そして、コンベヤ支持台４２６の移動により第２シフト位置へシフトさせられ、メインコンベヤ４０２へのプリント基板４０８の搬入に備えて待機させられる。メインコンベヤ４０２でのプリント基板４０８への回路部品８４２の装着が終了し、プリント基板４０８が搬出された後、搬入コンベヤ４０４からメインコンベヤ４０２へプ

リント基板４０８が搬入される。

【０１２６】搬出コンベヤ４０６は、メインコンベヤ４００から搬出されたプリント基板４０８を下流側に設けられたリフローシステムへ渡した後、コンベヤ支持台４２６の移動により第２シフト位置にシフトさせられてプリント基板４０８の搬出に備えて待機させられている。搬出コンベヤ４０６はプリント基板４０８を受け取った後、第１シフト位置へシフトさせられ、リフローシステムへプリント基板４０８を引き渡す。

【０１２７】搬入コンベヤ４０４からメインコンベヤ４０２へのプリント基板４０８の搬入後、プリント基板４０８はメインコンベヤ４０２において、メインコンベヤ４００におけると同様にして位置決め支持され、回路部品８４２の装着に備えて待機させられる。メインコンベヤ４００において位置決め支持されたプリント基板４０８への回路部品８４２の装着終了後、メインコンベヤ４０２において位置決め支持されたプリント基板４０８への回路部品８２４の装着が開始され、装着終了後、搬出コンベヤ４０６へ搬出される。

【０１２８】プリント基板４０８の種類が変わり、メインコンベヤ４００，４０２，搬入コンベヤ４０４および搬出コンベヤ４０６の搬送幅を変更する際には、各コンベヤ４００～４０６のいずれもがプリント基板４０８を支持していない状態で作業者がハンドル５１０を回転操作してチェーン４７０を移動させる。それにより各コンベヤ４００～４０６の可動フレーム４４２，５２６が一斉に同じ方向へ同じ距離移動させられ、搬送幅が同時に同じ大きさに変更される。

【０１２９】回路部品８４２のプリント基板４０８への装着を説明する。回路部品８４２のプリント基板４０８への装着は、２個の回路部品装着装置１８，２０により交互に行われる。回路部品装着装置１８，２０がそれぞれ回路部品８４２を取り出す回路部品供給装置は決まっており、回路部品装着装置１８は回路部品供給装置１４から回路部品８４２を取り出し、回路部品装着装置２０は回路部品供給装置１６から回路部品８４２を取り出す。それぞれ同じ側に設けられた回路部品供給装置から回路部品８４２を取り出すのであり、２個の回路部品装着装置１８，２０の各Ｙ軸スライド６５８，６６０が装着ヘッド６５０，６５２による回路部品８４２の取出し時および装着時に干渉することはない。

【０１３０】回路部品８４２の装着開始に先立ってプリント基板４０８の基準マークが、基準マーク撮像装置８５４により撮像される。基準マークの撮像は、前述のようにプリント基板４０８がメインコンベヤに搬入されるとともに位置決め支持され、装着に備えて待機している間に行われる。撮像は、待機中のプリント基板４０８を支持しているメインコンベヤとＹ軸方向において同じ側に設けられた回路部品装着装置の基準マーク撮像装置８５４により行われる。一方のメインコンベヤにより位置決め支持されたプリント基板４０８への回路部品８４２の装着が行われている間に、他方のメインコンベヤにプリント基板４０８が搬入され、位置決め支持されれば、そのメインコンベヤと同じ側に設けられた回路部品装着装置は、自身が保持する全部の回路部品８４２のプリント基板４０８への装着終了後、回路部品供給装置へ回路部品８４２を受け取りに行く途中で基準マークを撮像する。１枚のプリント基板４０８について、予定された全部の回路部品８４２の装着が終了する前であっても、次に回路部品８４２が装着されるプリント基板４０８が搬入されれば、基準マークの撮像が行われるのである。プリント基板４０８には対角線上に２個の基準マークが設けられており、コンピュータ１０５２は、回路部品８４２の吸着，装着等の制御の間に、撮像データに基づいてプリント基板４０８上の複数の部品装着箇所の各々についてＸ軸，Ｙ軸方向の位置誤差を演算してメモリに格納する。

【０１３１】２個の装着ヘッド６５０，６５２のうち、装着ヘッド６５０による回路部品８４２の装着を代表的に説明する。まず、装着ヘッド６５０は回路部品供給装置１４へ移動させられ、予め設定された数の回路部品８４２を回路部品供給装置１４から取り出す。ここでは装着ヘッド６５０の１回の回路部品８４２の装着数が２０個であり、２０個の部品吸着軸７６６の全部が回路部品８４２を吸着するものとする。また、説明を容易にするために、複数のフィーダ５４はプリント基板４０８への回路部品８４２の装着順に並べられており、間欠回転体７６２の１ピッチずつの間欠回転により、２０個の部品吸着ノズル７８４が間欠的に旋回させられるとともに、間欠回転体７６２の最短距離の移動により、順次回路部品８４２を吸着し、装着するものとする。

【０１３２】そのため、回路部品８４２の取出し時には、間欠回転体７６２の間欠回転により、２０個の部品吸着軸７６６が順次部品吸着装着位置に位置決めされるとともに、ＸＹロボット６６２により、回路部品８４２を供給するフィーダ５４の部品取出位置上へ移動させられる。なお、間欠回転体７６２が間欠回転させられるとき、駆動歯車７１６が同方向に同角速度で回転させられ、部品吸着軸７６６が回転させられないようにされる。

【０１３３】部品吸着軸７６６が部品吸着装着位置へ到達する前であって、カムフォロワ８０４が昇降駆動部材８９２の昇降駆動部８９６の下面に係合する状態になれば、リニアモータ８８６が起動され、移動部材８９０が下降させられるとともに昇降駆動部材８９２が下降させられ、部品吸着軸７６６が下降させられる。部品吸着軸７６６の旋回と下降とが並行して行われるのである。部品吸着軸７６６は、部品吸着ノズル７８４が回路部品８４２に接触する前に部品吸着装着位置に到達し、停止しており、部品吸着ノズル７８４は正確に回路部品８４２

に接触することができる。なお、部品吸着軸７６６が部品吸着装着位置において昇降駆動部材８９２により下降させられる場合にも、被駆動歯車８００は駆動歯車７１６に噛み合った状態に保たれる。

【０１３４】前記フィーダ５４により保持された部品収容テープ１５６は、エンボスタイプの部品収容テープであり、部品収容テープ１５６に収容された回路部品８４２の上面（被吸着面）の上下方向（部品吸着軸７６６の移動方向に平行な方向）の位置は、回路部品８４２の高さに関係なく一定である。また、１２個の部品吸着ノズル７８４は種類が同じであり、部品吸着装着位置に位置決めされた部品吸着ノズル７８４の吸着管７８８の下面（吸着面）の高さは一定である。そのため、部品吸着装着位置に位置決めされた部品吸着ノズル７８４の吸着管７８８の下面と、フィーダ５４により供給され、部品取出位置に位置する回路部品８４２の上面との距離は、回路部品８４２の種類に関係なく一定であり、昇降駆動部材８９２の昇降距離は一定であって、吸着管７８８の下面と回路部品８４２の上面との距離より僅かに大きくされている。昇降駆動部材８９２は、吸着管７８８が回路部品８４２に接触した後、更に小距離下降させられ、回路部品８４２が確実に吸着されるようにされているのであり、余分な下降距離は部品吸着ノズル７８４の圧縮コイルスプリング７９０の圧縮により吸収される。また、リニアモータ８８６が速度制御されることにより、部品吸着軸７６６は、下降開始時に滑らかに加速して下降させられた後、滑らかに減速させられて回路部品８４２に衝撃少なく当接させられる。昇降駆動部材８９２は、吸着管７８８が回路部品８４２に接触した後、小距離下降させられるときも減速され続けながら下降する。リニアモータ８８６を駆動源として部品吸着軸７６６を昇降させれば、下降速度および昇降距離を自由に設定することができ、回路部品８４２をより短い時間で吸着し、また、装着することができる。

【０１３５】図２５のタイムチャートに、ＸＹロボット６６２の作動時期（すなわち装着ヘッド６５０の移動時期）と、間欠回転体７６２の間欠回転時期と、部品吸着軸７６６の昇降時期との関係を示す。これら時期はそれぞれ、装着ヘッド６５０の移動速度，間欠回転体７６２の回転速度および部品吸着軸７６６の昇降速度で表されている。同図において山形を成す線のうち、時間の経過に従って頂点に向かう斜めの線は速度の増大を表し、頂点から離れる斜めの線は速度の減少を表す。保持方位補正変更とは、後述するように、部品吸着軸７６６により吸着された回路部品８４２の保持方位誤差の補正あるいは方位の予め設定された方位への変更であり、駆動歯車７１６が回転させられ、部品吸着軸７６６が回転させられることにより行われる。また、部品保持テープ送りは、フィーダ５４における部品収容テープ１５６の送りであり、撮像は回路部品撮像装置８２０による回路部品８４２の撮像である。撮像時期は、速度ではなく、有無で表されている。

【０１３６】移動部材８９０の下降と共に主エアシリンダ９３０が下降させられ、作用部材９５２が下降させられるとともに、リンク１０３０の回動により移動部材１０３４が上昇させられて作用部材１００２が上昇させられる。部品吸着時および装着時には、図２６に示すように、主エアシリンダ９３０，９７４および補助エアシリンダ９８４の駆動指令が出力され、主エアシリンダ制御用電磁弁１０６４，１０６６，補助エアシリンダ制御用電磁弁１０６８が切り換えられる。作用部材９５２，１００２を作用位置側へ移動させるように作動するエアシリンダについてはＯＮ指令が出力され、作用部材９５２，１００２を非作用位置側へ移動させるように作動するエアシリンダについてはＯＦＦ指令が出力される。それにより、回路部品８４２の吸着時には、図１９に示すように、主エアシリンダ９３０のピストンロッド９４６がシリンダチューブ９３４から突出させられ、作用部材９５２がシリンダチューブ９３４から突出した作用位置に位置させられる。また、主エアシリンダ９７４のピストンロッド９８２はシリンダチューブ９７６から突出させられ、補助エアシリンダ９８４のピストンロッド９９４はシリンダチューブ９８８内へ引っ込まされ、作用部材１００２が非作用位置に位置させられる。なお、以下、主エアシリンダ９３０，９７４および補助エアシリンダ９８４の各ピストンロッド９４６，９８２，９９４が突出状態あるいは引込状態にあることを、主エアシリンダ９３０，９７４および補助エアシリンダ９８４が突出状態あるいは引込状態にあると称する。

【０１３７】移動部材８９０の下降に伴って、図２７に示すように、作用部材９５２が圧力切換弁８６０の切換部材８７４に係合し、下方へ移動させる。この際、作用部材１００２は上昇するが切換部材８７４に係合せず、切換部材８７４が負圧供給位置へ移動させられて圧力切換弁８６０が負圧供給状態に切り換えられ、部品吸着ノズル７８４に負圧が供給される。このとき切換部材８７４は、ストッパ部８７６がハウジング８７２に当接して停止している。移動部材８９０および１０３４は、昇降駆動部材８９２の下降に伴って互いに逆向きに移動させられ、切換部材８７４に互いに反対側から作用するが、機械的に同期して移動させられるため、誤作動，作動遅れ等によって２つの作用部材９５２，１００２が同時に切換部材８７４に作用したり、作用時期が不適正になったりすることがない。回路部品８７４のプリント基板４０８への装着時も同じである。

【０１３８】圧力切換弁８６０は、吸着管７８８が回路部品８４２に当接する直前に吸着管７８８の先端開口部に負圧が供給されるタイミングで切り換えられ、吸着管７８８が回路部品８４２に接触した後、極く短時間で回路部品８４２を吸着するのに十分な高さの負圧が得ら

れ、迅速に回路部品８４２を吸着することができる。圧力切換弁８６０の切換タイミングは、下降開始時における主エアシリンダ９３０の移動部材８９０に対する上下方向の位置を調節することにより調節し得る。このように部品吸着ノズル７８４の下降と圧力切換弁８６０の切換えとは機械的に同期して行われるため、負圧の供給タイミングがずれることがなく、吸着ミスの発生が良好に回避される。回路部品８７４のプリント基板４０８への装着時も同じであり、負圧の解除タイミングがずれることがなく、装着ミスの発生が良好に回避される。

【０１３９】移動部材８９０（昇降駆動部材８９２）は、前述のように、吸着管７８８が回路部品８４２に接触した後、更に小距離下降させられるが、このときには、切換部材８７４が負圧供給位置まで移動し、ストッパ部８７６がハウジング８７２に当接して停止しており、余分な下降距離は作用部材９５２が圧縮コイルスプリング９６２を圧縮して移動部材８９０に対して相対移動することにより許容される。

【０１４０】回路部品８４２の吸着後、移動部材８９０が上昇させられ、昇降駆動部材８９２が上昇させられる。この際、部品吸着軸７６６は圧縮コイルスプリング８０６の付勢力により昇降駆動部材８９２に追従して上昇させられ、テープ状収容容器１５２から回路部品８４２を取り出す。移動部材８９０が上昇させられれば、主エアシリンダ９３０が上昇させられ、作用部材９５２が上昇させられて切換部材８７４から離間させられるが、切換部材８７４は負圧供給位置へ移動させられた状態に保たれ、回路部品８４２が部品吸着ノズル７８４により吸着された状態に保たれる。また、移動部材１０３４の下降により作用部材１００２が下降させられる。

【０１４１】移動部材８９０が上昇端位置へ到達して昇降駆動部８９６が固定カム７１２の切欠８９８に嵌合する前に間欠回転体７６２が回転を開始させられ、カムフォロワ８０４が昇降駆動部８９６の下面に沿って移動させられる。部品吸着軸７６６の旋回と上昇とが並行して行われるのである。部品吸着軸７６６の部品吸着および装着のための昇降と旋回とが並行して行われることにより、部品吸着装着位置に複数の部品吸着軸７６６が順次到達する時間ピッチを短くすることができ、回路部品８４２の装着能率を向上させることができる。移動部材８９０が上昇端位置へ到達し、昇降駆動部８９６が切欠８９８に嵌合した後、カムフォロワ８０４が固定カム７１２のカム面８０８に乗り移り、回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置から退避させられ、次に回路部品８４２を吸着する部品吸着軸７６６が部品吸着装着位置へ迅速に移動させられる。

【０１４２】次に回路部品８４２を吸着する部品吸着軸７６６は、装着ヘッド６５０がＸＹロボット６６２によってＸ軸方向へ移動させられることにより、回路部品８４２を供給するフィーダ５４の部品取出位置上へ移動させられる。なお、同じフィーダ５４から回路部品８４２が取り出されるのであれば、装着ヘッド６５０はＸ軸方向へは移動させられず、間欠回転体７６２が回転させられるのみである。フィーダ５４においては、回路部品８４２の取出し後、部品収容テープ１５６が１ピッチ送られ、次に取り出される回路部品８４２が部品取出位置に位置決めされる。

【０１４３】間欠回転体７６２が回転させられて部品吸着軸７６６が部品吸着装着位置へ移動させられるとき、リニアモータ８８６あるいは制御装置１０５０の誤作動等により、カムフォロワ８０４が昇降駆動部８９６の下面に係合する前に昇降駆動部材８９２が既に下降していてカムフォロワ８０４より下方に位置することがあれば、被駆動歯車８００や部品吸着軸７６６の軸部材７６８が昇降駆動部８９６に当接する。しかし、部品吸着軸７６６の旋回に伴って昇降駆動部材８９２に設定値以上の力が加えられれば、昇降駆動部材８９２は図２２に二点鎖線で示す退避位置へ回動させられ、昇降駆動部材８９２や部品吸着軸７６６等の損傷が回避される。昇降駆動部材８９２の退避位置への回動は移動検知装置９２０により検知され、その検知信号に基づいて吸着作業が停止させられる。異常原因の解消後、吸着が開始される。昇降駆動部材８９２が作用位置へ戻されるとともに、昇降駆動部８９６が切欠８９８に嵌合され、部品吸着軸７６６のカムフォロワ８０４が昇降駆動部８９６の下面に係合させられて吸着が再開される。回路部品８４２のプリント基板４０８への装着時も同じである。

【０１４４】なお、例えば、リニアモータ８８６や制御装置１０５０のリニアモータ８８６を制御する部分等の誤作動等と、旋回用サーボモータ７４２や制御装置１０５０の旋回用サーボモータ７４２を制御する部分等の誤作動等とが同時に生じ、本来、部品吸着軸７６６が部品吸着装着位置において停止すべきであるのに停止せず、かつ、部品吸着軸７６６の部品吸着装着位置の通過時に昇降駆動部材８９２が下降位置にあることがあっても、部品吸着軸７６６は旋回しつつ昇降駆動部材８９２を退避位置へ回動させ、また、カムフォロワ８０４は切欠８９８を乗り越えて損傷が回避される。

【０１４５】回路部品８４２は部品吸着軸７６６によりフィーダ５４から取り出された後、プリント基板４０８への装着前に回路部品撮像装置８２０により撮像される。部品吸着装着位置と撮像位置とは、図１６に示すように５ピッチ（間欠回転体７６２における２０個の部品吸着軸７６６の配設ピッチを１ピッチとする）離れており、回路部品８４２を吸着した部品吸着軸７６６は、間欠回転体７６２の間欠回転により、他の部品吸着軸７６６が部品吸着装着位置へ移動させられるのと並行して撮像位置へ移動させられる。そして、回路部品８４２が回路部品撮像装置８２０により撮像され、Ｘ軸，Ｙ軸方向の各保持位置誤差および保持方位誤差が演算される。撮

像位置における回路部品８４２の撮像は、吸着する回路部品８４２の数等によっては、部品吸着装着位置における回路部品８４２の吸着と並行して行われ、また、装着と並行して行われることもあるが、撮像のみが行われることもある。それについては後に説明する。２０個の部品吸着軸７６６は間欠回転体７６２に搭載されていて、間欠回転体７６２の間欠回転により、回路部品８４２を吸着していない部品吸着軸７６６あるいは回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置へ移動させられるのと並行して、回路部品８４２を吸着した部品吸着軸７６６が撮像位置へ移動させられるため、回路部品８４２の吸着と撮像とを並行して行い、装着と撮像とを並行して行うことが可能であり、撮像結果に基づく保持位置誤差および保持方位誤差の算出に必要な時間を確保しつつ回路部品８４２の装着能率を向上させることができる。

【０１４６】２０個の部品吸着軸７６６の全部が回路部品８４２を吸着したならば、装着ヘッド６５０はＸＹロボット６６２によりプリント基板４０８上へ移動させられ、回路部品８４２を装着する。回路部品８４２の装着は、Ｘ軸スライド６５４上においては部品吸着時と同じ位置で行われる。プリント基板４０８に回路部品８４２を装着する部品吸着軸７６６は、間欠回転体７６２の回転により部品吸着装着位置に位置決めされ、ＸＹロボット６６２によって装着ヘッド６５０が移動させられることにより、プリント基板４０８の部品装着箇所上へ移動させられる。回路部品８４２の吸着と装着とが同じ位置で行われるため、吸着，装着時に部品吸着軸７６６を昇降させるための駆動源（リニアモータ８８６）が１つで済み、装置を安価に構成することができるとともに、ＸＹロボット６６２作動時の慣性負荷が小さくて済み、装着ヘッド６５０を高速で移動させ得る。

【０１４７】部品吸着軸７６６が間欠回転体７６２の回転により部品吸着装着位置に位置決めされるのと並行して、回路部品８４２は保持方位誤差が補正されるとともに、予めプログラムされた角度により設定される方位へ回転させられる。駆動歯車７１６を間欠回転体７６２に対して相対回転させ、部品吸着軸７６６を自身の軸線のまわりに回転させるのである。

【０１４８】駆動歯車７１６は全部の部品吸着軸７６６に固定の各被駆動歯車８００と噛み合わされており、保持方位誤差を補正すべき部品吸着軸７６６以外の部品吸着軸７６６も回転させられる。そのため、２番目以降に回路部品８４２を装着する部品吸着軸７６６については、自身の保持方位誤差および設定された方位に加えて、先に回路部品８４２を装着した部品吸着軸７６６の回転角度および方向に基づいて回転角度および方向が設定される。また、ＸＹロボット６６２の移動距離は、回路部品８４２およびプリント基板４０８の部品装着箇所の各Ｘ軸，Ｙ軸方向の位置誤差を解消すべく、補正される。

【０１４９】部品装着時にも部品吸着時と同様に、部品吸着軸７６６が部品吸着装着位置に到達する前であって、カムフォロワ８０４が昇降駆動部材８９２の昇降駆動部８９６の下面に係合した状態で移動部材８９０が下降させられ、部品吸着軸７６６が下降させられる。回路部品８４２をプリント基板４０８に載置するときには、部品吸着軸７６６は部品吸着装着位置に至って停止しており、正確に回路部品８４２をプリント基板４０８に装着することができる。

【０１５０】移動部材８９０が下降させられれば、作用部材９５２が下降させられるとともに作用部材１００２が上昇させられるが、回路部品８４２の装着時には、主エアシリンダ９３０は引込状態とされ、作用部材９５２が非作用位置に位置させられている。それに対し、作用部材１００２は回路部品８４２の吸着時より高く、切換部材８７４に近い作用位置に位置させられていて、当接部材１０１４が圧力切換弁８６０の切換部材８７４に係合して上方へ移動させ、負圧解除位置へ移動させて圧力切換弁８６０を負圧解除状態に切り換える。このとき、切換部材８７４は、ストッパ部８７８がハウジング８７２に当接して停止する。

【０１５１】作用部材１００２は、後述するように、主エアシリンダ９７４が引込状態とされ、補助エアシリンダ９８４が突出状態とされることにより得られる作用位置と、主，補助エアシリンダ９７４，９８４が共に引込状態とされることにより得られる作用位置であって、主エアシリンダ９７４のみが引込状態とされることにより得られる作用位置より高い作用位置とに選択的に位置させられる。

【０１５２】圧力切換弁８６０へのエアの供給，遮断を制御する電磁開閉弁１０２４は、当接部材１０１４が切換部材８７４に当接する前に開かれており、圧力切換弁８６０が負圧解除状態に切り換えられれば、直ちに圧力切換弁８６０から部品吸着ノズル７８４に向かってエアの供給が開始され、回路部品８４２が迅速に解放される。当接部材１０１４が切換部材８７４に当接するとき、圧力切換弁８６０と部品吸着ノズル７８４とを接続する通路７８０，８６２等内は負圧状態になっており、圧力切換弁８６０が負圧解除状態に切り換えられて圧力切換弁８６０に供給されるエアが吸着管７８８の先端開口部に到達するまでに時間を要するが、回路部品８４２を迅速に解放するためには、この時間を短くすることが必要である。供給されるエアの流量が多ければ到達時間を短くすることができるが、回路部品８４２を吸着管７８８から離間させるには多過ぎて、回路部品８４２をプリント基板４０８上で移動させ、あるいは吹き飛ばしてしまう恐れがある。そのため、当接部材１０１４に溝１０１６が設けられ、エアが漏らされて流量が減少するようにされている。圧力切換弁８６０が負圧解除状態に切

り換えられた後、エアが吸着管７８８の先端開口部に到達するまでの間も溝１０１６からエアが漏れるが、圧力切換弁８６０の切換直後は、圧力切換弁８６０と部品吸着ノズル７８４とを接続する通路７８０等内が負圧状態にあるため、溝１０１６からエアが漏れても、供給されるエアの多くが部品吸着ノズル７８４へ流れ、吸着管７８８の先端開口部に迅速にエアが供給される。吸着管７８８の先端開口部にエアが供給され、部品吸着ノズル７８４内の圧力が大気圧に近くなり、あるいは大気圧以上まで増大すれば、圧力切換弁８６０と部品吸着ノズル７８４とを接続する通路７８０等内の圧力が増大するため、溝１０１６からのエアの漏れ量が増える一方、部品吸着ノズル７８４へ流れるエアの流量が減少し、回路部品８４２を吸着管７８８から離間させるのに適当な量のエアが得られる。

【０１５３】可変絞り弁１０２６の絞り量は、このように部品吸着ノズル７８４に迅速にエアが供給され、部品吸着ノズル７８４内の圧力が上昇した後は、溝１０１６からのエアの漏れにより回路部品８４２が適切な量のエアによって吸着管７８８から離間させられる量に設定される。可変絞り弁１０２６のエアの絞り量の調節によって部品吸着ノズル７８４内へ供給されるエアと大気中に漏れるエアとの総流量を調節することができ、結果的に、圧力切換弁８６０の負圧解除状態への切換直後と、圧力増大後とにおける部品吸着ノズル７８４へのエアの流量の比を調節することができる。なお、部品吸着ノズル７８４が複数種類搭載されている場合には、中間の大きさの部品吸着ノズル７８４に合わせて絞り量が設定される。

【０１５４】また、当接部材１０１４が切換部材８７４に当接した当初は、圧力切換弁８６０が負圧解除位置に切り換えられておらず、通路１０２２は切換部材８７４により塞がれ、部品吸着ノズル７８４から遮断されているため、通常であればエアの流れが一旦停止してしまう。しかし、溝１０１６が設けられているため、溝１０１６を通ってエアが流出してエアの流れができるため、切換部材８７４が負圧解除位置へ切り換えられ、負圧の供給が遮断されると同時に遅滞なく、また脈動少なく部品吸着ノズル７８４に向かってエアが供給される。

【０１５５】このように回路部品８４２は、エアの供給によって迅速に解放されるため、圧力切換弁８６０の負圧解除状態への切換えは、回路部品８４２がプリント基板４０８に接触した後に吸着管７８８の先端開口部にエアが供給されるタイミングで行われる。回路部品８４２がプリント基板４０８に載置される前に吸着管７８８の先端開口部にエアが供給されれば、回路部品８４２の位置がずれる恐れがあるからである。

【０１５６】回路部品８４２の高さが高いほど、短い下降距離でプリント基板４０８に接触し、圧力切換弁８６０の負圧解除状態への切換時期（エアの供給による回路部品８４２の解放時期）を早くすることができる。圧力切換弁８６０の切換時期は、回路部品８４２の高さに応じて設定することが望ましいが、作用部材１００２の作用位置が２種類に変更され、圧力切換弁８６０の切換時期が２種類に変更されるようになっている。そのため、回路部品８４２を高さに応じて大小２種類に分類し、大きい回路部品８４２については、移動部材８９０の下降距離が短くされるとともに、作用部材１００２の作用位置が高い側に選択されて圧力切換弁８６０の切換時期が早くされ、小さい回路部品８４２については、移動部材８９０の下降距離が長くされるとともに、作用部材１００２の作用位置が低い側に選択されて圧力切換弁８６０の切換時期が遅くされる。

【０１５７】具体的には、高さが０より大きく３㎜以下の回路部品８４２が小さい回路部品８４２とされ、３㎜より大きく、６㎜以下の回路部品８４２が大きい回路部品８４２とされている。大小いずれの分類においても、移動部材８９０の下降距離は、各分類に属する複数種類の回路部品８４２のうち、高さが最も小さい回路部品８４２に合わせて設定される。図２８および図２９に示すように、部品吸着装着位置に位置決めされた部品吸着軸７６６の吸着管７８８の下面とプリント基板４０８との間の距離を１４㎜とすれば、小さい回路部品８４２の場合、下降距離は（１４＋α）㎜とされ、大きい回路部品８４２の場合は（１１＋α）㎜とされる。高さが最も小さい回路部品８４２が確実にプリント基板４０８に接触するようにされているのである。なお、作用部材１００２の２つの作用位置の上下方向の距離の差は３㎜とされている。

【０１５８】圧力切換弁８６０の切換タイミングは、作用部材１００２の移動部材１０３４に対する上下方向の位置を調節することにより、すなわち、補助エアシリンダ９８４の主エアシリンダ９７４に対する上下方向の位置および支持部材９９８の補助エアシリンダ９８４に対する上下方向の位置をそれぞれ調節することにより調節可能である。圧力切換弁８６０の切換タイミングは、大きい回路部品８４２の装着時および小さい回路部品８４２の装着時のいずれにおいても、各分類に含まれる回路部品８４２のうち、高さが最も小さい回路部品８４２がプリント基板４０８上に載置された後に、吸着管７８８の先端開口部にエアが供給されるタイミングで圧力切換弁８６０の切換えが行われるように調節されている。大小の各分類にそれぞれ属する回路部品８４２のうち、高さが大きい回路部品８４２についてはエアの供給時期が遅れるが、いずれの回路部品８４２についても、プリント基板４０８への載置後にエアの供給により解放されることが保証されているのである。移動部材８９０の下降距離は、回路部品８４２が確実にプリント基板４０８に載置されるとともに、上記のように設定されたタイミングで圧力切換弁８６０が切り換えられ、切換部材８７４

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のストッパ部８７８がハウジング８７２に当接して負圧解除位置へ移動した状態となることが保証される大きさに設定されている。

【０１５９】高さが０より大きく、３㎜以下の回路部品８４２のプリント基板４０８への装着時には、図２６に示す駆動指令に従って主エアシリンダ９３０，９７４および補助シリンダ９８４が駆動され、図２８（ａ）に示すように、主エアシリンダ９７４が引込状態とされるとともに補助エアシリンダ９８４が突出状態とされ、作用部材１００２が下側の作用位置にあって、圧力切換弁８６０の切換時期が遅くなるようにされる。また、主エアシリンダ９３０は引込状態とされ、作用部材９５２は非作用位置に位置させられて切換部材８７４に接触しないようにされる。なお、図２８（ａ），（ｂ）および後述する図２９（ａ），（ｂ）には、図示の都合上、切換弁制御装置８８２を構成する部材の一部が図示されている。

【０１６０】移動部材８９０の下降により、図２８（ｂ）に示すように、回路部品８４２がプリント基板４０８に接触し、その後、更に移動部材８９０が小距離下降させられる。この下降は、部品吸着ノズル７８４の圧縮コイルスプリング７９０の圧縮により許容される。

【０１６１】また、当接部材１０１４が切換部材８７４を上方へ移動させ、圧力切換弁８６０が負圧解除状態に切り換えられる。この切換え後の移動部材８９０の下降（移動部材１０３４の上昇）は、支持部材９９８が引張コイルスプリング１００６を延ばしつつ作用部材１００２に対して上方へ移動することにより許容され、当接部材１０１４および圧力切換弁８６０の損傷が回避される。吸着管７８８の先端開口部へのエア供給から設定時間、すなわち回路部品８４２を解放するのに十分な時間、エアが供給された後、電磁開閉弁１０２４が閉じられ、エアの供給が遮断される。

【０１６２】回路部品８４２の装着時にも、リニアモータ８８６は移動部材８９０の下降速度が加速，減速するように制御され、回路部品８４２が衝撃少なくプリント基板４０８に接触させられる。下降距離は、大小同じ分類に属する複数種類の回路部品８４２について共通であるが、回路部品８４２のプリント基板４０８への接触時期は回路部品８４２の高さが大きいほど早いため、大小同じ分類に属する回路部品８４２であっても、減速開始時期は回路部品８４２の高さが大きいほど早くされる。

【０１６３】高さが大きい回路部品８４２のプリント基板４０８への装着時には、図２９（ａ）に示すように、主エアシリンダ９７４および補助エアシリンダ９８４が共に引込状態とされ、圧力切換弁８６０の切換時期が早くなるようにされる。そして、移動部材８９０の下降により、図２９（ｂ）に示すように作用部材１００２が上昇し、当接部材１０１４が切換部材８７４に接触して負圧解除位置へ移動させる。回路部品８４２のプリント基板３８への載置後、吸着管７８８の先端開口部にエアが供給されて回路部品８４２が解放される。

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【０１６４】回路部品８４２の装着後、移動部材８９０が上昇させられるとともに、間欠回転体７６２が回転させられ、次に回路部品８４２をプリント基板４０８に装着する部品吸着軸７６６が部品吸着装着位置に位置決めされる。また、ＸＹロボット６６２により装着ヘッド６５０が移動させられ、部品吸着装着位置が別の部品装着箇所上へ移動させられる。回路部品８４２の装着時にも、部品吸着軸７６６の上昇と間欠回転体７６２の間欠回転とが並行して行われ、次に回路部品８４２を装着する部品吸着軸７６６が迅速に部品吸着装着位置に位置決めされる。

【０１６５】このように、回路部品８４２の吸着時には、吸着管７８８が回路部品８４２に接触する前に吸着管７８８の先端開口部に負圧が供給されて迅速に回路部品８４２を吸着することができ、回路部品８４２の装着時には、移動部材８９０の下降距離および圧力切換弁８６０の負圧解除状態への切換時期が回路部品８４２の高さに応じて２種類に変更され、移動部材８９０の無駄な下降が少なくされるとともに、回路部品８４２がプリント基板４０８への載置後にエアの供給によって迅速に解放されることにより、部品吸着に要する時間および部品装着に要する時間が短くなり、装着能率の高い回路部品装着装置１８，２０が得られる。

【０１６６】図２５のタイムチャートに示すように、ＸＹロボット６６２の作動による装着ヘッド６５０の水平移動，間欠回転体７６２の間欠回転，回路部品８４２の保持方位誤差の補正および変更，部品吸着軸７６６の部品装着のための昇降が繰り返し行われて、装着ヘッド６５０において保持された全部の回路部品８４２がプリント基板４０８に装着されたならば、装着ヘッド６５０は次に装着する回路部品８４２の取出しのために回路部品供給装置１４へ移動する。回路部品装着装置１８による回路部品８４２の装着中に、回路部品装着装置２０は回路部品供給装置１６から回路部品８４２の取出しを行っており、回路部品装着装置１８による回路部品８４２の装着終了後、直ちに交替してプリント基板４０８への回路部品８４２の装着を開始する。プリント基板４０８へは殆ど休みなく回路部品８４２が装着され、能率良く装着が行われるのである。

【０１６７】なお、吸着エラーが発生した場合、例えば吸着された回路部品８４２が予定された種類とは異なる場合、あるいは回路部品８４２の保持方位誤差が過大である場合等には、回路部品８４２はプリント基板４０８に装着されない。部品吸着軸７６６が部品吸着装着位置に位置決めされてもリニアモータ８８６が起動されず、部品吸着軸７６６が下降させられないのである。そして、装着ヘッドが保持する全部の回路部品８４２（吸着エラーのあった回路部品８４２は除く）の装着終了後、

回路部品供給装置へ移動する間に装着ヘッドは図示しない回路部品収容器上へ移動させられ、エラーのあった回路部品８４２が捨てられる。このとき、捨てられる回路部品８４２を吸着した部品吸着軸７６６は部品吸着装着位置に位置決めされており、その部品吸着軸７６６が回路部品収容器上に至った後、あるいは回路部品収容器上に至る直前にリニアモータ８８６が起動される。作用部材９５２が非作用位置に、作用部材１００２が作用位置に位置させられており、移動部材８９０の下降により作用部材１００２が切換部材８７４に係合して負圧解除位置へ移動させ、圧力切換弁８６０が負圧解除状態に切り換えられて回路部品８４２が捨てられる。作用部材１００２が上側の作用位置に位置させられていれば、下側の作用位置に位置させられた場合よりも、リニアモータ８８６の起動後、短い時間で回路部品８４２が解放される。装着ヘッドは、回路部品収容器上において停止させられた状態で回路部品８４２を捨てるが、回路部品収容器が長手形状の収容器であれば、装着ヘッドを停止させることなく、移動しつつ回路部品８４２を捨てることも可能である。

【０１６８】前述のように、回路部品８４２を吸着した部品吸着軸７６６は、吸着後、次の部品吸着軸７６６が間欠回転体７６２の回転により部品吸着装着位置へ移動させられるのと並行して撮像位置に向かって移動させられ、撮像位置に至ったとき、回路部品８４２が回路部品撮像装置８２０により撮像される。しかし、部品吸着装着位置と撮像位置とは５ピッチ離れており、装着する回路部品８４２の数が５個以下の場合は勿論、２０個であっても、予定数の回路部品８４２の吸着が終了したとき、撮像の済んでいない回路部品８４２が生ずる。

【０１６９】そのため、①回路部品装着装置１８，２０の１回の部品吸着数が２０個であり、２０個の部品吸着軸７６６の全部が回路部品８４２の吸着に使用される場合であって、１番目ないし５番目に吸着される回路部品８４２の方位変更角度が０±１５度（－１５度以上＋１５度以下、他も同じ），９０±１５度，１８０±１５度および２７０±１５度の範囲内の場合、②回路部品装着装置１８，２０の１回の部品吸着数が２０個であり、２０個の部品吸着軸７６６の全部が回路部品８４２の吸着に使用される場合であって、１番目ないし５番目に吸着される回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲外の角度の場合、③部品吸着数が２０個より少ない場合の３つの場合についてそれぞれ、予定された全部の回路部品８４２の吸着後における回路部品８４２の撮像が異なる態様で行われる。

【０１７０】回路部品８４２は、部品吸着軸７６６により回路部品供給装置１４，１６により供給された際の方位とは異なる方位でプリント基板４０８に装着されることがある。方位変更角度とは、回路部品８４２を供給時（部品吸着軸７６６の部品受取り時）の方位（誤差を含まない方位）から装着時の方位へ回転させるための角度であり、回路部品８４２の種類，装着箇所等に応じて装着プログラムにおいて予め設定されている。なお、方位変更角度は、部品吸着軸７６６を一方向へ回転させる角度で設定されているが、実際の回転角度および方向は、回路部品８４２を最小の回転角度で方位変更角度により設定された方位へ回転させる角度および方向に設定される。

【０１７１】まず、①についてを説明する。回路部品８４２の吸着数が２０個の場合、図３０に示すように、１番目から１５番目の回路部品８４２は、６番目から２０番目の回路部品８４２の吸着と並行して撮像され、方位誤差角度θ１ａ～θ１５ａが画像認識角度として取得される。そして、２０番目の部品吸着軸７６６が回路部品８４２を吸着した状態から間欠回転体７６２が１ピッチ回転させられれば、１番目に回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置に戻り、回路部品８４２をプリント基板４０８に装着することができる。

【０１７２】しかし、吸着終了時には１６番目ないし２０番目に吸着された回路部品８４２（以下、１６番目ないし２０番目の回路部品８４２と称する。１番目ないし１５番目に吸着された回路部品８４２についても同じ。）については撮像が行われていないため、１番目ないし５番目の回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲内である場合は、１番目ないし５番目の回路部品８４２のプリント基板４０８への装着と並行して、１６番目ないし２０番目の回路部品８４２の撮像が行われる。

【０１７３】このことは、本回路部品装着システム８において、撮像の結果、回路部品８４２が０度，９０度，１８０度，２７０度に対して±３０度の範囲を超えて傾斜している場合、吸着エラーが発生したと判断され、装着されないようにされていることと関連がある。本回路部品装着システム８においては、２０個の部品吸着軸７６６にそれぞれ固定された被駆動歯車８００は共通の駆動歯車７１６に噛み合わされており、プリント基板４０８に装着される回路部品８４２を回転させるとき、他の部品吸着軸７６６も同角度、同方向へ回転させられる。そのため、装着と撮像とが並行して行われる場合、撮像される回路部品８４２の方位には、その回路部品８４２自身の方位誤差角度のみならず、並行して装着される回路部品８４２の方位変更角度および方位誤差補正角度も含まれている。したがって、並行して装着される回路部品８４２の方位変更角度および方位誤差補正角度の方向および大きさを考慮に入れない単純な規則で、撮像された回路部品８４２に過大な保持方位誤差が発生しているか否かを判定するためには、回路部品８４２が０度，９０度，１８０度，２７０度を中心として±αの範囲を外

れた場合には過大な保持方位誤差が発生したとすることが必要であり、±αの大きさは、撮像される回路部品の方位誤差角度と、並行して装着される回路部品８４２の方位変更角度および方位誤差補正角度とを考慮して決定されるべきである。方位誤差角度と方位誤差補正角度とが０である極限の状態を考えれば、αは４５度自体を除外する大きさとすればよいのであるが、実際には方位誤差角度と方位誤差補正角度とは０ではないため、４５±βの範囲を除外する大きさに設定することが必要である。

【０１７４】本回路部品装着システム８においては、方位誤差角度が殆どの場合±５度以内であり、何らかの異常が発生した場合でなければ±１０度を超えることはないという事実を考慮して、±αが次のようにして±３０度と決められている。１番目ないし５番目の回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲内である場合は、１番目ないし５番目の回路部品８４２がプリント基板４０８に装着される際に回転させられるとしても殆どの場合２０度以内である。例えば、保持方位誤差が＋５度生じていて、方位変更角度が－１５度であれば、回転角度は２０度になるからである。そのため、撮像される回路部品８４２に保持方位誤差が＋５度生じており、それに加えて２０度回転させられても撮像される回路部品８４２の回転角度は２５度であって、±３０度の範囲外となることはない。なお、１番目ないし５番の回路部品８４２の保持方位誤差が＋１０度、撮像される回路部品８４２の保持方位誤差が＋１０度である場合には、撮像される回路部品８４２の回転角度は最大３５度になるが、そのようなことは実際上、殆ど生ぜず、吸着エラーが生じていないのに生じているとして回路部品８４２が廃棄される確率は極めて小さく、実用上問題はない。装着と撮像とを並行して行うようにしても支障は殆どないのである。

【０１７５】このように１番目ないし５番目の回路部品８４２の装着と、１６番目ないし２０番目の回路部品８４２の撮像とが並行して行われる場合、２０個の回路部品８４２の吸着終了後、間欠回転体７６２は、ＸＹロボットにより水平移動させられ、部品吸着装着位置がプリント基板４０８の部品装着箇所上へ移動させられる間に、１ピッチ間欠回転させられるとともに部品吸着軸７６６が自身の軸線のまわりに回転させられる。それにより１番目の回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置へ移動させられるとともに、回路部品８４２は保持方位誤差を補正され、かつ、方位変更角度により設定された方位へ回転させられ、移動後、直ちにプリント基板４０８に装着される。

【０１７６】図３０に示すように、１番目の回路部品８４２を保持する部品吸着軸７６６のトータルの回転角度は（－θ１ａ＋θ１ｂ）であり、１６番目の回路部品８４２の画像認識角度は、１番目の回路部品８４２の回転角度（－θ１ａ＋θ１ｂ）を含み、（θ１６ａ－θ１ａ＋θ１ｂ）となる。そのため、１６番目の回路部品８４２の装着時吸着軸トータル回転角度は、方位誤差角度（θ１６ａ－θ１ａ＋θ１ｂ）を解消するための角度に自身の方位変更角度θ１６ｂを加えた角度（－θ１６ａ＋θ１ａ－θ１ｂ）＋θ１６ｂとなる。１７番目ないし２０番目の回路部品８４２についても同じである。また、２番目以降の部品吸着軸７６６は、先に回路部品８４２を装着した部品吸着軸７６６の回転時に同時に回転させられているため、自身が保持する回路部品８４２の方位誤差角度および方位変更角度に加えて、先に回路部品８４２を装着した部品吸着軸７６６の回転角度および方向に基づいて部品吸着軸７６６の回転角度および方向が設定される。この回転角度および方向は、回路部品８４２を最小の角度で方位変更角度により設定された方位へ回転させる角度および方向に設定される。

【０１７７】②を説明する。１番目ないし５番目の回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲外の角度の場合、回路部品８４２のプリント基板４０８への装着開始に先立って、それら５個の回路部品８４２の撮像が行われる。１番目ないし５番目の回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲外の角度の場合は、回路部品８４２が±３０度以上傾いていて吸着エラーと判断されることがあり得るため、装着と撮像とが並行しては行われないのである。

【０１７８】そのため、１６番目ないし２０番目の回路部品８４２の撮像は、図２５のタイムチャートに示すように、装着ヘッドがＸＹロボットによって水平移動させられ、部品吸着装着位置がプリント基板４０８の部品装着箇所上へ移動させられる間に行われる。この撮像のために間欠回転体７６２が５ピッチ分、９０度回転させられることにより、１番目に回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置から撮像位置側へ４ピッチ離れた位置へ移動させられる。そのため、２０番目の回路部品８４２の撮像後、間欠回転体７６２が逆方向へ４ピッチ分、回転させられ、１番目に回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置へ移動させられる。また、この移動と並行して１番目の部品吸着軸７６６が自身の軸線のまわりに回転させられ、回路部品８４２の保持方位誤差が補正されるとともに、方位変更角度により設定された方位へ回転させられる。

【０１７９】この際、１６番目ないし２０番目の回路部品８４２の撮像に要する時間が装着ヘッドの水平移動に要する時間より短ければ、図２５のタイムチャートに示すように、装着ヘッドの水平移動中に間欠回転体７６２が回転させられるとともに、部品吸着軸７６６が回転させられることとなる。撮像時間の方が長ければ、装着ヘ

ッドの水平移動終了後にも間欠回転体７６２が回転させられるとともに部品吸着軸７６６が回転させられる。

【０１８０】図３１に示すように、１番目の回路部品８４２の方位誤差角度はθ１ａ度であり、誤差を補正するためには－θ１ａ度回転させることが必要である。また、方位変更角度をθ１ｂ度とすれば、回路部品８４２はトータル（－θ１ａ＋θ１ｂ）度回転させることとなる。２番目以降の回路部品８４２についても同様であり、部品吸着軸７６６は間欠回転体７６２の１ピッチの回転によって部品吸着装着位置へ移動させられるのと並行して回転させられる。２番目以降の部品吸着軸７６６については、先に回路部品８４２を装着した部品吸着軸７６６の回転角度および方向に基づいて部品吸着軸７６６の回転角度および方向が設定されることは、①の場合と同じである。

【０１８１】③を説明する。装着する回路部品８４２の数が１５個ないし１９個の場合、吸着する全部の回路部品８４２の数をＮ個とすれば、先頭から数えて（Ｎ－１５）個の回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲外の角度であれば、前記②の場合と同様に、予定された全部の数の回路部品８４２の吸着後、全部の回路部品８４２について撮像が行われた後に、１番目に回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置に戻されて回路部品８４２を装着する。

【０１８２】なお、吸着する回路部品８４２の数が１５個の場合、（Ｎ－１５）は０であり、回路部品８４２の撮像位置への到達と部品吸着装着位置への到達とが並行して起こることはなく、部品吸着終了後、装着を伴わない間欠回転が５回行われ、全部の回路部品８４２が撮像される。回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲内の場合も同じである。

【０１８３】先頭から数えて（Ｎ－１５）個の回路部品８４２の方位変更角度が０±１５度，９０±１５度，１８０±１５度および２７０±１５度の範囲内であれば、間欠回転体７６２の間欠回転により、１番目に回路部品８４２を吸着した部品吸着軸７６６が部品吸着装着位置へ到達するまでの間、撮像位置に至った部品吸着軸７６６が保持する回路部品８４２の撮像のみが行われ、１番目の回路部品８４２が部品吸着装着位置に至った後は、装着と撮像とが並行して行われる。撮像のみが（２０－Ｎ）回行われる。換言すれば、（２０－Ｎ）回の装着を伴わない間欠回転が行われるのである。

【０１８４】例えば、装着される回路部品８４２の数が１７個の場合、図３２に示すように、全部の回路部品８４２の吸着後、回路部品８４２の装着を伴わない間欠回転体７６２の間欠回転が３回行われ、１番目の回路部品８４２が部品吸着装着位置に向かって移動させられるとともに、１３番目ないし１５番目の回路部品８４２が撮像される。４ピッチ目の回転により１番目の回路部品８４２が部品吸着装着位置に到達するため、この間欠回転の間に部品吸着軸７６６が自身の軸線のまわりに回転させられ、回路部品８４２の保持方位誤差が補正されるとともに、方位変更角度により設定された方位へ回転させられる。１６番目および１７番目の回路部品８４２の撮像は１番目および２番目の回路部品８４２の装着と並行して行われ、それらの画像認識角度には、１番目および２番目の回路部品８４２の回転角度が含まれることとなる。

【０１８５】１７個の回路部品８４２の吸着後、装着ヘッドが水平移動させられ、プリント基板４０８上へ移動させられる。この間に１３番目ないし１５番目の回路部品８４２の撮像が行われ、撮像が水平移動より先に終了すれば、水平移動と並行して１番目の部品吸着軸７６６の部品吸着装着位置への移動および回転が行われる。撮像時間の方が長ければ、装着ヘッドの水平移動の終了後にも撮像が行われるとともに、１番目の部品吸着軸７６６の部品吸着装着位置への旋回および自身の軸線まわりの回転が行われることとなる。

【０１８６】装着される回路部品８４２の数が１４個以下の場合、装着と撮像とが並行して行われることはなく、６個以上１４個以下の場合は、全部の回路部品８４２の吸着後に間欠回転体７６２が５回間欠回転させられて、全部の回路部品８４２が撮像される。また、装着される回路部品８４２の数が５個以下の場合は、回路部品８４２の数だけ間欠回転体７６２が間欠回転させられる。ただし、５個以下の場合は、装着される回路部品８４２が全部吸着されても、１番目に回路部品８４２を吸着した部品吸着軸７６６は撮像位置に至らない。そのため、全部の回路部品８４２が吸着された後、１番目に回路部品８４２を吸着した部品吸着軸７６６を撮像位置に移動させるべく、間欠回転体７６２が回路部品８４２が位置する位置と、撮像位置との間のピッチ分、一度に回転させられ、その後、間欠回転体７６２がＮ回間欠回転させられて撮像が行われる。

【０１８７】このように装着される回路部品８４２の数が１４個以下の場合も、撮像は間欠回転体７６２の水平移動と並行して行われ、撮像が水平移動より先に終了すれば、水平移動と並行して間欠回転体７６２が回転させられ、１番目の部品吸着軸７６６が部品吸着装着位置へ移動させられるとともに自身の軸線のまわりに回転させられる。撮像が水平移動の後に終了すれば、撮像の終了後、１番目の部品吸着軸７６６が部品吸着装着位置へ移動さらせられるとともに、自身の軸線のまわりに回転させられる。また、撮像終了後、１番目に回路部品８４２を吸着した部品吸着軸７６６を部品吸着装着位置へ移動させるとき、間欠回転体７６２の回転方向は、最も回転角度が少なくて済む方向に設定される。

【０１８８】以上の説明から明らかなように、本実施形

態においては、部品吸着軸７６６は部品保持具の一種である部品吸着具であって、部品保持具の一種である部品保持軸を構成し、部品吸着ノズル７８４が部品吸着軸７６６の部品保持部たる部品吸着部を構成している。旋回用サーボモータ７４２および制御装置１０５０の旋回用サーボモータ７４２を制御して間欠回転体７６２を間欠回転させる部分が、２０個の部品吸着軸７６６を部品吸着装着位置および撮像位置に順次位置決めする保持具位置決め装置を構成し、搬送用移動部材たるＸ軸スライド６５４，６５６を有するＸＹロボット６６２，６６４が搬送用移動装置を構成している。メインコンベヤ４００，４０２の昇降台５９８，昇降台昇降装置６００，基板吸着具６０２および案内部材５６６，５６８の押さえ部５７０，５７２が回路基材保持装置を構成している。また、間欠回転体７６２，被駆動プーリ７４０，駆動プーリ７４４等が上記保持具位置決め装置と共に保持具旋回装置の一種である吸着具旋回装置を構成している。前記搬送用移動装置は保持具旋回装置を保持して移動するのであり、吸着具旋回装置は、ＸＹロボットと共に吸着具移動装置を構成している。さらに、リニアモータ８８６は、昇降駆動部材８９２を昇降させる昇降駆動装置を構成し、昇降駆動部材８９２と共に、部品受取装着位置である部品吸着装着位置近傍に位置する部品吸着軸７６６を昇降させる個別の昇降装置を構成している。カム部材たる固定カム７１２，カムフォロワ８０４，圧縮コイルスプリング８０６が、部品保持具を移動軌跡に沿って昇降させる昇降装置を構成している。制御装置１０５０の部品吸着装着位置において部品吸着軸７６６に回路部品供給装置１４，１６から供給される回路部品８４２を受け取らせ、あるいはプリント基板４０８に回路部品８４２を装着させる部分が受取装着制御装置を構成している。制御装置１０５０は、保持具旋回装置，搬送用移動装置，個別昇降装置および受取装着制御装置を制御するのである。さらに、複数の部品吸着軸７６６，保持具旋回装置，搬送用移動装置，個別昇降装置および受取装着制御装置が装着ユニットを構成し、本実施形態においては装着ユニットが２セット設けられており、制御装置１０５０のそれら２セットの装着ユニットを制御し、回路部品８４２の受取りおよび装着を交互に行わせる部分が交互装着制御手段を構成している。制御装置１０５０の部品吸着軸７６６による回路部品８４２の保持位置誤差に基づいて搬送用移動装置の移動距離を補正し、保持具旋回装置の回路基材保持装置に対する位置決めを補正する部分が位置決め補正手段を構成している。さらに、駆動歯車７１６，被駆動歯車８００，駆動源たる方位補正変更用サーボモータ７２４が保持具回転装置を構成し、制御装置１０５０の回路部品８４２の保持方位誤差に基づいて保持具回転装置を制御し、保持方位誤差を補正する部分が方位補正手段を構成している。また、図３０および図３２に基づいて説明したように、制御装置１０５

０の部品吸着軸７６６による回路部品８４２の装着と回路部品撮像装置８２０による回路部品８４２の撮像とを並行して行わせる部分が並行撮像制御手段を構成している。間欠回転体７６２は、部品保持具の軸部材を軸方向に移動可能かつ回転可能に保持し、その軸部材の軸線と交差する方向に移動する移動部材であり、間欠回転により回路部品を搬送する回路部品搬送装置の構成要素でもある。さらに、制御装置１０５０の主エアシリンダ９３０，９７４，補助エアシリンダ９８４を制御する部分がアクチュエータ制御装置を構成し、それら主エアシリンダ９３０，９７４，補助エアシリンダ９８４等と共に、昇降駆動部材８９２が部品吸着ノズル７８４を下降させるのに伴って切換部材８７４を圧力切換弁８６０が部品吸着ノズル７８４内の圧力を大気圧以上から負圧に切り換える負圧供給位置へ移動させる吸着実現状態と、昇降駆動部材８９２が部品吸着ノズル７８４を下降させるのに伴って切換部材８７４を圧力切換弁８６０が部品吸着ノズル７８４内の圧力を負圧から大気圧以上の圧力に切り換える負圧解除位置へ移動させる解放実現状態とに切換えが可能な切換弁制御装置８８２を構成している。また、リンク１０３０，ローラ１０３６，１０４２が、昇降駆動部材８９２の移動方向を逆にして移動部材１０３４に伝達する伝達装置を構成し、作用部材１００２を付勢する引張コイルスプリング１００６が、主エアシリンダ９７４および補助エアシリンダ９８４により作用部材１００２に与えられる作動力が設定値を超えた場合には、作用部材１００２がエアシリンダ９７４，９８４に対して相対移動することを、弾性的な抵抗を付与しつつ許容する相対移動許容装置を構成し、作用部材９５２を付勢する圧縮コイルスプリング９６２も同様に相対移動許容装置を構成している。通路１０２０，１０２２が作用部材１００２に形成された正圧供給通路を構成し、圧力切換弁８６０内に形成され、通路１０２０，１０２２に連通させられてエアが供給される通路も通路１０２０，１０２２と共に正圧供給通路を構成している。

【０１８９】第１ないし第５，第８，第９発明に共通の別の実施形態を図３３ないし図３７に示す。本実施形態は、複数の部品吸着軸を間欠回転体に、複数の部品吸着軸の旋回軸線を中心線とする円錐面の複数の母線の各々が軸線となる状態で保持させるとともに、上記旋回軸線を、搬送平面に対する垂線に対して、円錐面の一母線が搬送平面と直交する状態となる角度だけ傾斜させたものである。その他の構成は、前記実施形態と同じであり、異なる部分のみを説明する。

【０１９０】装着ヘッド１１００は、前記装着ヘッド６５０，６５２と同様に、ＸＹロボット１１０２により水平移動させられる。ＸＹロボット１１０２を構成するＸ軸スライド１１０４は、図３３に示すように、複数の部材が互いに固定されて成る。複数の部材の１つは被支持部材１１０６であり、被案内部材たる一対のガイドブロ

ック１１０８が固定されるとともに、図示しないＹ軸スライドに設けられた一対の案内部材たるガイドレール１１１０に移動可能に嵌合されている。被支持部材１１０６にはナット１１１２が固定されるとともに、Ｙ軸スライドに回転可能に取り付けられたねじ軸１１１４に螺合されている。これらナット１１１２およびねじ軸１１１４はボールねじを構成している。ねじ軸１１１４には、Ｘ軸サーボモータ１１１６の回転がカップリング１１１８により伝達され、ねじ軸１１１４が回転させられてＸ軸スライド１１０４がＸ軸方向に移動させられる。カップリング１１１８は、Ｘ軸サーボモータ１１１６の出力軸１１２０とねじ軸１１１４との各軸線にずれがあっても、そのずれを吸収しつつＸ軸サーボモータ１１１６の回転をねじ軸１１１４に伝達する。

【０１９１】被支持部材１１０６のＸ軸方向の一端部には、図３３および図３５に示すように、一対の取付部１１２４が下方へ、かつＸ軸方向の他端部側へ向かう向きに突設されており（図３３には一方のみ図示されている）、これら取付部１１２４に支持部材１１２６が固定されている。支持部材１１２６は、図３３および図３４に示すように、一対の腕部１１２７を有し、これら腕部１１２７においても被支持部材１１０６に固定されている。また、被支持部材１１０６のＸ軸方向の他端部には、取付部材１１２８が下方へ延び出す向きに固定されている。

【０１９２】支持部材１１２６には、図３３に示すように、回転軸１１３２が複数の軸受１１３４により回転可能に取り付けられている。なお、組立の都合上、支持部材１１２６は複数の部材が互いに固定されて成り、支持部材１１２６の回転軸１１３２の上部を回転可能に支持する部分は、支持部材１１２６の被支持部材１１０６に固定される部分に対して着脱可能に固定されている。

【０１９３】回転軸１１３２の下部には、被駆動プーリ１１３６が固定されている。被駆動プーリ１１３６には、支持部材１１２６にブラケット１１３７により取り付けられた駆動源たる旋回用サーボモータ１１３８の回転が駆動プーリ１１４０およびタイミングベルト１１４２により伝達され、回転軸１１３２が正逆両方向に任意の角度回転させられる。

【０１９４】回転軸１１３２には、軸受１１４６を介して中空軸１１４８が回転可能に嵌合されている。中空軸１１４８の下端部には駆動歯車としての駆動かさ歯車１１５０が固定され、上端部には被駆動プーリ１１５２が固定されている。被駆動プーリ１１５２には、支持部材１１２６に取り付けられた駆動源たる方位補正変更用サーボモータ１１５４の回転が駆動プーリ１１５６およびタイミングベルト１１５８により伝達され、駆動かさ歯車１１５０が正逆両方向に任意の角度回転させられる。

【０１９５】回転軸１１３２の中空軸１１４８から下方への突出端部には、部品吸着軸保持部材１１６２が固定され、回転軸１１３２と共に間欠回転体１１６４を構成している。部品吸着軸保持部材１１６２には、１６個の保持穴１１６６が形成されている（図３３には２個のみ図示されている）。これら保持穴１１６６は、回転軸１１３２の回転軸線を中心線とする円錐面の１６本の母線の各々を中心線として形成されており、回転軸１１３２は前記支持部材１１２６に、回転軸線が水平な搬送平面に対する垂線に対して、上記円錐面の一母線が搬送平面と直交する状態となる角度だけ傾斜した状態で取り付けられている。前記旋回用サーボモータ１１３８および方位補正変更用サーボモータ１１５４も、各回転軸線がそれぞれ回転軸１１３２の回転軸線と平行となる向きに傾斜した状態で支持部材１１２６に取り付けられている。

【０１９６】上記保持穴１１６６の各々には、図３７に示すように、スリーブ１１６８が嵌合され、固定されている。スリーブ１１６８は、保持穴１１６６に嵌合されるとともに、取付部１１７２において部品吸着軸保持部材１１６２に固定手段たるボルト（図示省略）によって固定されている。部品吸着軸保持部材１１６２の取付部１１７２が固定される面は平面とされ、多角錐の外周面を構成している。

【０１９７】スリーブ１１６８には、軸受１１７６を介して回転部材１１７８が回転可能に嵌合されている。回転部材１１７８の下端部には大径の当接部１１８０が設けられ、上端部には被駆動歯車としての被駆動かさ歯車１１８２が嵌合されるとともに、雄ねじ部１１８４にナット１１８６が螺合されている。被駆動かさ歯車１１８２は、当接部１１８０との間に一対の軸受１１７６を挟んで回転部材１１７８に固定されているのであり、前記駆動かさ歯車１１５０に噛み合わされている。

【０１９８】回転部材１１７８に部品吸着軸１１７０が嵌合されている。部品吸着軸１１７０は、軸部材１１９０と、軸部材１１９０にアダプタ１１９２により取り付けられた部品吸着ノズル１１９４とを有し、軸部材１１９０は回転部材１１７８に軸方向に相対移動可能に嵌合されている。軸部材１１９０の回転部材１１７８から突出した下端部に大径のノズル保持部１１９６が設けられている。軸部材１１９０の上端部は回転部材１１７８から突出させられ、軸受１２００が取付部材１１９８によって取り付けられており、軸受１２００と前記ナット１１８６との間に配設された付勢手段の一種である弾性部材としての圧縮コイルスプリング１２０２により、部品吸着軸１１７０は上方へ付勢されている。部品吸着軸１１７０の圧縮コイルスプリング１２０２の付勢力に基づく上方への移動限度は、回転部材１１７８の当接部１１８０の下面に固定された摩擦リング１２０４に、ノズル保持部１１９６が当接することにより規定される。摩擦リング１２０４は摩擦係数の高い材料（例えばゴム）により作られており、摩擦リング１２０４とノズル保持部１１９６との摩擦係合により、回転部材１１７８の回転

が軸部材１１９０に伝達される。

【０１９９】ノズル保持部１１９６には、下面に開口する段付状の嵌合穴１２１０が設けられ、アダプタ１１９２が軸方向に移動可能に嵌合されている。アダプタ１１９２はノズル保持部１１９６に等角度間隔に取り付けられた複数の保持部材１２１２によって保持されるとともに、付勢手段の一種である弾性部材としての圧縮コイルスプリング１２１４により、ノズル保持部１１９６から下方へ突出する向きに付勢されている。

【０２００】ノズル保持部１１９６には、軸部材１１９０の軸線に平行に延びる複数の切欠１２１６が等角度間隔に形成され、前記複数の保持部材１２１２の各々が回動可能に嵌合されるとともに、ノズル保持部１１９６に巻き付けられたリング状のばね部材１２１８によってノズル保持部１１９６に保持されている。保持部材１２１２の切欠１２１６に嵌合された部分の上側には、ノズル保持部１１９６の中心側に突出する突部１２２０が設けられるとともに、ノズル保持部１１９６に形成された切欠１２２２に嵌合されており、この突部１２２０の切欠１２２２の底面への当接部を中心として、保持部材１２１２がその長手方向に直角で、部品吸着軸１１７０の保持部材１２１２が取り付けられた部分に対する接線方向に延びる軸線まわりに回動可能である。さらに、保持部材１２１２の突部１２２０の上側には操作部１２２４が突設され、ノズル保持部１１９６に形成された切欠１２２６に嵌合されている。保持部材１２１２は、切欠１２１６への嵌合と、操作部１２２４の切欠１２２６への嵌合とによって、部品吸着軸１１７０の軸線と直交する軸線まわりの回動が阻止されている。

【０２０１】保持部材１２１２の下部は、アダプタ１１９２の大径の係合部１２３０に形成された切欠１２３２に嵌合されており、ノズル保持部１１９６とアダプタ１１９２との相対回転を阻止している。また、保持部材１２１２の下端部にはアダプタ１１９２側へ突出する係合突部１２３４が突設され、この係合突部１２３４が係合部１２３０に下方から係合することにより、アダプタ１１９２の嵌合穴１２１０からの抜出しを防止している。この状態で前記操作部１２２４を押して保持部材１２１２をばね部材１２１８の付勢力に抗して回動させ、係合突部１２３４と係合部１２３０との係合を解くことにより、アダプタ１１９２をノズル保持部１１９６から外すことができる。

【０２０２】部品吸着ノズル１１９４は、吸着管保持体１２４０に保持された吸着管１２４２を有し、吸着管保持体１２４０に設けられたテーパ部１２４４においてアダプタ１１９２に設けられたテーパ穴１２４６にテーパ嵌合されるとともに、ばね部材１２４８によりアダプタ１１９２に保持されている。ばね部材１２４８はほぼコの字形を成し、コの字の一対の腕部においてアダプタ１１９２に形成された一対の切欠１２５２に嵌合され、それら腕部間の距離は先端ほど狭くされて締まり勝手とされている。また、それら腕部間の先端部は互いに接近する向きに曲げられ、アダプタ１１９２からの脱落が防止されている。

【０２０３】テーパ部１２４４がテーパ穴１２４６に嵌合されれば、ばね部材１２４８はテーパ部１２４４に形成された円環状の嵌合溝１２５４に嵌入し、テーパ部１２４４に係合して吸着管保持体１２４０を保持するとともに、テーパ穴１２４６内に引き込んで位置決めする。ばね部材１２４８のアダプタ１１９２に対する取付位置は、テーパ部１２４４がテーパ穴１２４６に嵌合された状態で、ばね部材１２４８の円形状の断面の中心位置に対して、半円形断面の嵌合溝１２５４の中心位置が下方へずれた状態となる位置とされており、ばね部材１２４８は嵌合溝１２５４の溝側面の上側の部分に係合して吸着管保持体１２４０をテーパ穴１２４６内に引き込む。符号１２５６は、部品吸着ノズル１１９４の反射板である。このようにアダプタ１１９２に保持された部品吸着ノズル１１９４は、アダプタ１１９２ごと、軸部材１１９０に対して着脱される。

【０２０４】部品吸着軸保持部材１１６２の外周面には、１６個の部品吸着軸１１７０の各々に対応して１６個の圧力切換弁１２６０が固定されている。圧力切換弁１２６０は切換部材１２６１を有し、部品吸着軸１１７０の軸線と平行に固定されている。圧力切換弁１２６０は、図３３および図３７に示すように、部品吸着軸保持部材１１６２内に形成された通路１２６２，回転軸１１３２内に形成された通路１２６４，１２６６および支持部材１１２６内に形成された円環状通路１２６８等を介して図示しない真空装置に接続されている。

【０２０５】圧力切換弁１２６０は、図３７に示すように、部品吸着軸保持部材１１６２内に形成された別の通路１２７０，スリーブ１１６８内に形成された通路１２７２，シール保持部材１２７４に形成された通路１２７６，回転部材１１７８内に形成された通路１２８０により、部品吸着軸１１７０の軸部材１１９０内に形成された通路１２８２に接続されている。通路１２８０は円環状を成すとともに、軸方向に長く、部品吸着軸１１７０が回転部材１１７８に対して回転および軸方向に移動しても、通路１２８２は通路１２８０と連通した状態に保たれる。

【０２０６】部品吸着軸１１７０の１６個の停止位置のうち、部品吸着軸１１７０の軸線が水平な搬送平面と直交する状態となる位置が部品吸着装着位置であり、部品吸着装着位置から９０度離れた位置が撮像位置とされている。間欠回転体１１６４の間欠回転により部品吸着軸１１７０が旋回させられるとき、１１７０の位置が最も低くなる位置が部品吸着装着位置とされ、それより高い位置が撮像位置とされているのである。前記支持部材１１２６の撮像位置に対応する位置には、図３６に示すよ

うに、ブラケット１２８８により回路部品撮像装置１２９０が固定されている。回路部品撮像装置１２９０は、前記回路部品撮像装置と同様に構成されており、図示しない照明装置，反射装置１２９４およびＣＣＤカメラ１２９６を備えている。撮像位置においては部品吸着軸１１７０の軸線が搬送平面に対する垂線に対して傾斜し、回路部品撮像装置１２９０は、その光軸が部品吸着軸１１７０の軸線と直角となる向きに設けられている。回路部品撮像装置１２９０は、図３３に示すように、水平な搬送平面に対しても傾斜させられている。

【０２０７】Ｘ軸スライド１１０４を構成する取付部材１１２８には、図３４に示すように、基準マーク撮像装置１３００が搭載されている。取付部材１１２８にはまた、図３３に示すように、部品吸着装着位置に対応する部分に個別昇降装置１３０２および切換弁制御装置１３０４の主要部が取り付けられている。取付部材１１２８にはリニアモータ１３１０が取り付けられており、リニアモータ１３１０の可動子１３１２に固定された移動部材１３１４には、昇降駆動部材１３１６が固定されている。昇降駆動部材１３１６は、部品吸着装着位置に位置決めされた部品吸着軸１１７０の上方へ突出する昇降駆動部たる係合部材１３１８を有する。

【０２０８】切換弁制御装置１３０４は、前記切換弁制御装置８８２と同様に構成されており、移動部材１３１４には、圧力切換弁１２６０を負圧供給位置に切り換えるために、主アクチュエータたる主エアシリンダ１３２０および主エアシリンダ１３２０により作用位置と非作用位置とに移動させられる作用部材１３２２が取り付けられている。取付部材１１２８にはまた、図示は省略するが、圧力切換弁１２６０を負圧解除位置に切り換えるための主アクチュエータたる主エアシリンダ，補助アクチュエータたる補助エアシリンダ，移動部材および作用部材等が取り付けられており、リニアモータ１３１０によって移動部材１３１４が移動させられるとき、２つの移動部材が機械的に同期して互いに逆向きに移動し、２つの作用部材が互いに対称に昇降して選択的に切換部材１２６１に作用し、圧力切換弁１２６０を負圧供給状態と負圧解除状態とに切り換える。

【０２０９】以上のように構成された回路部品装着システムにおいて回路部品の装着時には、前記実施形態におけると同様に、ＸＹロボット１１０２の作動および間欠回転体１１６４の間欠回転により、複数の部品吸着軸１１７０が回路部品供給装置へ移動させられて回路部品を吸着し、吸着後、プリント基板上へ移動させられて回路部品を装着する。

【０２１０】回路部品の吸着時には、間欠回転体１１６４の間欠回転により１６個の部品吸着軸１１７０が順次部品吸着装着位置へ移動させられる。このとき、駆動かさ歯車１１５０が間欠回転体１１６４と同方向に同角速度で回転させられ、部品吸着軸１１７０が自身の軸線のまわりに回転しないようにされる。部品吸着軸１１７０が部品吸着装着位置へ到達した後、移動部材１３１４の下降により昇降駆動部材１３１６が下降させられ、部品吸着軸１１７０が下降させられる。部品吸着軸１１７０が下降させられれば、軸部材１１９０のノズル保持部１１９６が摩擦リング１２０４から離れるが、部品吸着軸１１７０が回転部材１１７８に対して回転することはない。例えば、圧縮コイルスプリング１２０２にねじりが生ずれば、部品吸着軸１１７０を回転部材１１７８に対して回転させる回転トルクが生ずるが、圧縮コイルスプリング１２０２の一端部は、部品吸着軸１１７０により軸受１２００を介して支持されているため、圧縮コイルスプリング１２０２は部品吸着軸１１７０に対して回転し、部品吸着軸１１７０が回転させられることはないのである。

【０２１１】部品吸着軸１１７０の下降の途中で圧力切換弁１２６０が負圧供給状態に切り換えられて部品吸着ノズル１１９４に負圧が供給され、回路部品を吸着する。吸着後、昇降駆動部材１３１６が上昇させられれば、部品吸着軸１１７０は圧縮コイルスプリング１２０２の付勢力により上昇させられ、回路部品がフィーダから取り出される。

【０２１２】回路部品を吸着した部品吸着軸１１７０が間欠回転体１１６４の回転によって撮像位置に至れば、回路部品が回路部品撮像装置１２９０により撮像される。前記実施形態におけると同様に、装着される回路部品の数および１番目ないし４番目の回路部品の方位変更角度の大きさに応じて装着と撮像とが並行してあるいは別々に行われる。

【０２１３】回路部品の装着時には、複数の部品吸着軸１１７０が順次部品吸着装着位置に位置決めされる。間欠回転体１１６４の間欠回転により、回路部品をプリント基板に装着する部品吸着軸１１７０が部品吸着装着位置へ移動させられるとき、間欠回転体１１６４の回転中に、駆動かさ歯車１１５０が間欠回転体１１６４に対して相対回転させられて部品吸着軸１１７０が自身の軸線のまわりに回転させられ、回路部品の保持方位誤差が補正されるとともに、回路部品が方位変更角度により設定された方位へ回転させられる。駆動かさ歯車１１５０の回転は、被駆動かさ歯車１１８２，回転部材１１７８，摩擦リング１２０４，ノズル保持部１１９６，保持部材１２１２，アダプタ１１９２から部品吸着ノズル１１９４へ伝達され、回路部品が回転させられる。部品吸着軸１１７０の部品吸着装着位置への到達後、昇降駆動部材１３１６が下降させられ、部品吸着軸１１７０が下降させられて回路部品がプリント基板に装着される。また、移動部材１３１４の下降により圧力切換弁１２６０が負圧解除状態に切り換えられ、回路部品のプリント基板への接触後、部品吸着ノズル１１９４にエアが供給されて回路部品が解放される。回路部品の高さに応じて部品吸

着軸１１７０の昇降距離および圧力切換弁１２６０の負圧解除状態への切換時期が２種類に変更されることは、前記実施形態におけると同じである。

【０２１４】本回路部品装着システムにおいては、複数の部品吸着軸１１７０に共通の旋回軸線が搬送平面に対する垂線に対して傾斜させられているため、間欠回転体１１６４が回転させられるとき、部品吸着軸１１７０が旋回させられつつ昇降（水平な搬送平面に対して接近，離間）させられる。部品吸着軸１１７０の位置は部品吸着装着位置において最も低くなり、撮像位置は部品吸着装着位置より高く、部品吸着軸１１７０の上昇によって得られる隙間に回路部品撮像装置１２９０を設けることができ、回路部品撮像装置１２９０と部品吸着軸１１７０および部品吸着軸１１７０により保持された回路部品との干渉や、回路部品撮像装置１２９０と回路部品供給装置との干渉を回避しながら、部品吸着装着位置における部品吸着軸１１７０の昇降距離を短くすることができる。また、回路部品撮像装置１２９０は、水平な搬送平面に対しても傾斜させられているため、回路部品撮像装置１２９０の搬送平面に直角な方向における寸法が、撮像位置を部品吸着軸１１７０が水平な姿勢になる位置に設定して回路部品撮像装置１２９０を搬送平面に対して直角に設ける場合に比較して小さくて済み、Ｘ軸スライド１１０４をコンパクトに構成することができ、搬送速度を高くすることができる。

【０２１５】なお、先の説明において２０個の部品吸着ノズル７８４は種類が同じであって、各吸着管７８８の径は同じとされ、図１６に概略的に示すように等角度間隔に設けられていたが、図３８に概略的に示すように、吸着管の径が大小２種類に異なる１０個ずつの部品吸着ノズル１３３０と１３３２とを等角度間隔にかつ交互に設けてもよい。なお、図３８に図示されているのは、部品吸着ノズル１３３０，１３３２の反射板である。これら部品吸着ノズル１３３０および１３３２は、図３９に概略的に示すように、吸着管の径が同じ部品吸着ノズル同士を寄せて設けてもよい。

【０２１６】さらに、図４０に示すように、吸着管の径が異なる３種類の部品吸着ノズル１３４０，１３４２および１３４４を設けることも可能である。吸着管の径に関係なく、部品吸着軸の軸部の直径が同じであり、共通の保持穴に嵌合可能であれば、吸着管の径が大きい部品吸着ノズルを有する部品吸着軸については、保持穴に１個おきにあるいは複数個おきに嵌合すればよい。吸着管の径に応じて部品吸着軸の軸部の径が異なり、共通の保持穴を使用できなければ、間欠回転体を部品吸着軸の軸部の径に応じた複数種類の保持穴を有するものとすればよい。さらにまた、間欠回転体に保持させる全部の部品吸着軸を、吸着管の径が部品吸着ノズル１３４４のように大きい部品吸着ノズルを有するものとし、部品吸着軸を１０個等角度間隔に設けてもよい。部品吸着ノズル１３４４より更に大きい径の吸着管を有する部品吸着ノズルが取り付けられた部品吸着軸を設けてもよい。さらに部品吸着ノズルを４種類以上設けてもよい。回路部品の大きさに応じた径の吸着管を有する部品吸着ノズルを設ければ、大きい回路部品でも確実に保持されるため、間欠回転体の間欠回転速度を低くしなくても回路部品がずれることがなく、装着能率の低下を回避することができる。

【０２１７】なお、前記実施形態において、部品吸着具内の圧力増大後における部品吸着具からのエアの噴出流量を調節する可変絞り弁１０２６は、圧力切換弁８６０と直列に設けられていたが、図４１に示すように圧力切換弁１４００と並列に設けてもよい。例えば、圧力切換弁１４００のエアが供給される部分の一部を大気に連通させるとともに、可変絞り手段としての可変絞り弁１４０２を設けるのである。当接部材が切換部材に当接する前に電磁開閉弁１４０４が開かれていて、エア供給源１４０６から絞り１４０８を介してエアが供給され（図中、白丸が当接部材と切換部材との当接を表す）、圧力切換弁１４００が負圧解除状態に切り換えられれば、エアが吸着管１４１０に供給される。吸着管１４１０の圧力が大気圧近くあるいは大気圧以上になるまでは、エアの多くは吸着管１４１０に供給され、圧力増大後は可変絞り弁１４０２から大気中に流出するエアの流量が増大して、吸着管１４１０には回路部品を離間させるのに適当な量のエアが供給される。

【０２１８】可変絞り弁１４０２の絞り作用を強くすれば（エアの漏れ量を少なくすれば）、吸着管１４１０の圧力が大気圧近くあるいは大気圧以上になったときの吸着管１４１０からのエアの噴出流量が多くなり、絞りを弱くすれば、吸着管１４１０からのエアの噴出流量が少なくなる。圧力切換弁１４００は２０個の部品吸着軸の各々について設けられており、装着する回路部品の種類が変わり、部品吸着ノズルが交換されれば、その部品吸着ノズルの吸着管の径に応じて可変絞り弁１４０２の絞り量を調節する。それにより吸着管の径に応じた量のエアが供給され、回路部品が多量のエアによって吹き飛ばされることなく、迅速かつ確実に吸着管から離間させられる。

【０２１９】なお、エアの漏れ量を可変絞り弁１４０２によって調節するとともに、絞り１４０８を可変絞りとし、エア供給源から供給されるエアの流量をも調節するようにすれば、圧力切換弁の負圧解除状態への切換直後と部品吸着ノズル内の圧力増大後とにおける部品吸着ノズルへのエアの流量の比を一層正確に調節できる。

【０２２０】また、前記実施形態においては、当接部材１０１４に溝１０１６が形成されて、当接部材１０１４が切換部材８７４に接触した状態においても通路１０２２等を大気に連通させていたが、溝１０１６に代えて、貫通孔を設けてもよい。当接部材１０１４の上面に開口

する通路１０２２と交差し、当接部材１０１４を貫通する貫通孔を設けてエアを流出させるのである。

【０２２１】先の説明においてフィーダ５４は、プリント基板４０８への回路部品８４２の装着順に並べられ、２０個の部品吸着ノズル７８４が間欠回転体７６２に設けられた順に回路部品８４２を吸着し、装着するようにされており、吸着時，装着時における間欠回転体７６２の移動距離が少なくて済むようにされているものとしたが、例えば、回路部品供給装置１４，１６が複数種類のプリント基板４０８への回路部品８４２の装着に使用される場合には、すべての種類のプリント基板４０８について、フィーダ５４の並び順とプリント基板４０８の回路部品の装着順とを同じにすることはできない。この場合に間欠回転体７６２を１ピッチずつ間欠回転させて２０個の部品吸着ノズル７８４に回路部品８４２を装着順に吸着させようとすれば、順不動に並んでいるフィーダ５４のうち次に吸着させるべき回路部品を収容しているものの位置へ間欠回転体７６２を順次移動（Ｘ軸方向の移動）させることが必要であり、部品吸着のための間欠回転体７６２の移動距離が長くなることを避け得ない。逆に、間欠回転体７６２を１ピッチずつ間欠回転させつつフィーダ５４の並び順に従って回路部品８４２を吸着させることにすれば、間欠回転体７６２の移動距離は最短となる（不要な回路部品８４２を収容しているフィーダ５４をパスするために間欠回転体７６２の移動距離が大きくなることはあるが、これは止むを得ない）が、プリント基板４０８への装着順が最適ではなくなって、装着のための間欠回転体７６２の移動（Ｘ，Ｙ軸方向の移動）距離が長くなることを避け得ない。これら２つのモードのいずれかを固定的に選択して実施することも可能であるが、部品装着作業能率向上の観点からは、部品吸着のための間欠回転体７６２の移動距離と装着のための間欠回転体７６２の移動距離との和が最小になるように吸着順序と装着順序との両方を適宜変更するモードが好適である。この移動距離の和が最小となるようにする対策と共に、あるいはその対策に代えて、間欠回転体７６２の間欠回転角度が複数ピッチや逆回転を含むことを許容すれば、それによっても部品装着作業能率を向上させることができる。以上、説明の容易化のために間欠回転体に搭載される部品保持具は一種類としたが、実際には複数種類とされることもあり、その場合には、さらに部品保持具の種類や配列をも考慮して、効率良く回路部品を吸着，装着するように、吸着順序および装着順序を設定することが望ましい。例えば、間欠回転体に複数種類の部品保持具が搭載され、あるいは２種類の異なる部品保持具が交互に設けられる場合等には、間欠回転体を部品保持具の配設ピッチとは異なる角度で正方向あるいは逆方向に回転させて、複数の部品保持具に、間欠回転体に搭載された順序とは異なる順序で回路部品を吸着および装着させて、回路部品の吸着，装着を効率良く行うようにするのである。

【０２２２】さらに、前記実施形態において、メインコンベヤは２つ設けられていたが、３つ以上設けてもよい。その場合、複数個の流体圧シリンダを組み合わせて搬入コンベヤおよび搬出コンベヤをそれぞれ、メインコンベヤにつらなる３つ以上のシフト位置へシフトさせてもよく、あるいはサーボモータを駆動源としてシフトさせてもよい。例えば、コンベヤ支持台に搬入コンベヤの移動範囲にわたってねじ軸を設けるとともに搬入コンベヤに固定のナットを螺合し、ねじ軸をサーボモータにより回転させて搬入コンベヤを３つ以上のシフト位置へ選択的に移動させるのである。

【０２２３】サーボモータを用いて搬入コンベヤおよび搬出コンベヤを移動させるのであれば、搬入コンベヤおよび搬出コンベヤを任意の位置に停止させることができ、シフト位置以外の任意の位置にも停止させることができる。例えば、搬入コンベヤ，搬出コンベヤおよび２つのメインコンベヤを備えた回路部品装着システムの上流側の装置がスクリーン印刷機あるいは接着剤塗布装置等の高粘性流体塗布装置を有する塗布システムであって、回路基材を回路部品装着システムに引き渡すためのコンベヤが２つ並列に設けられているが、それらコンベヤの配設ピッチ（コンベヤが並ぶ方向の距離）が２つのメインコンベヤの配設ピッチと異なることがあり、搬入コンベヤは、２つのメインコンベヤとつらなるシフト位置以外に、上流側装置の２つのコンベヤにつらなって回路基材を受け取る受取位置へ移動しなければならない。そのような場合、搬入コンベヤをサーボモータを駆動源として移動させるのであれば、プログラムの設定により、搬入コンベヤを２つのシフト位置の他に２つの受取位置においても停止させ、回路基材を受け取らせることができる。回路部品装着システムの下流側に設けられた下流側装置が、例えば、半田を溶融させて回路部品を回路基材に電気的に接続するリフロー炉を有する半田溶融システムであったり、あるいはコンデンサ等、１つの回路基材への装着数が少ない回路部品を装着する装置を有する回路部品装着システム等であって、回路基材を搬出コンベヤから受け取って搬送するコンベヤが２つ並列に設けられており、それらコンベヤの配設ピッチが２つのメインコンベヤの配設ピッチと異なる場合も、搬出コンベヤをサーボモータを駆動源として移動させることにより、対応することができる。

【０２２４】また、先の説明においては、１番目ないし５番目の回路部品の方位変更角度が０±１５度、９０±１５度、１８０±１５度、２７０±１５度の範囲外の角度のとき、装着ヘッドが予定された全部の回路部品を回路部品供給装置から取り出した後、プリント基板への移動中に撮像が行われ、移動後、迅速に回路部品のプリント基板への装着を開始することができるようにされているが、取り出した全部の回路部品について撮像を行った

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後にプリント基板へ移動させてもよい。装着する回路部品の数が１９個以下であって、全部の回路部品の吸着後に撮像のみが行われる場合も同様である。

【０２２５】また、前記実施形態において、部品収容テープはエンボスタイプのテープとされており、回路部品の種類が異なっても、回路部品の上面の上下方向（部品保持軸の移動方向に平行な方向）の位置は一定とされていたが、例えば、部品保持テープがエンボスタイプではなく、テープ状収容容器の回路部品が収容された部分が下方から支持されて搬送されるタイプのテープである場合、回路部品の高さによって回路部品の上面の位置が異なる。この場合、部品吸着軸が回路部品を吸着する際の負圧の供給タイミングおよび部品吸着軸の昇降距離は回路部品の高さに応じて調節することが望ましい。例えば、装着時に圧力切換弁の負圧解除状態への切換えタイミングを２種類に変更するのと同様に、圧力切換弁の切換部材を負圧供給位置へ移動させる作用部材について、主および補助のアクチュエータたる主および補助のエアシリンダを設け、作用部材の作用位置を２種類に変更するようにする。また、昇降駆動部材の昇降距離も２種類に変更し、高さが大きい回路部品については昇降距離を短くする。圧力切換弁の切換タイミングは、負圧供給状態に切り換える場合でも、負圧解除状態に切り換える場合でも、２種類に限らず、例えば、補助アクチュエータを２個以上互いに直列に設けて３種類以上に変更するようにしてもよい。

【０２２６】さらに、プリント基板の基準マークの撮像は、プリント基板への回路部品の装着が行われている間に限らず、装着終了時あるいは装着終了直前に行うようにしてもよい。次に回路部品の装着が行われるプリント基板を支持するメインコンベヤと同じ側に設けられた回路部品装着装置において、回路部品の装着が、その回路部品装着装置にとって１枚のプリント基板への最後の装着であるか否かは装着プログラムからわかり、最後であれば、回路部品供給装置へ回路部品を取出しに行く途中で撮像を行うのである。その回路部品装着装置による装着でプリント基板への回路部品８４２の装着が終了するのであれば、プリント基板の回路部品への装着終了後に基準マークの撮像が行われることとなり、次に他方の回路部品装着装置により回路部品の装着が行われてプリント基板への回路部品８４２の装着が終了するのであれば、装着の終了直前に基準マークの撮像が行われることとなる。コンピュータは、回路部品の装着やプリント基板の搬入，搬出等の制御の間に撮像データに基づいてプリント基板の部品装着箇所の位置誤差を演算し、メモリに格納する。プリント基板への回路部品の装着開始前に全部の部品装着箇所の位置誤差が演算されていることは不可欠ではなく、回路部品の装着と並行して演算してもよい。そのようにすれば、保持方位誤差や保持位置誤差を記憶する記憶手段の記憶容量が少なくて済む。

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【０２２７】また、先の説明において、回路部品に±３０度を超える保持方位誤差があれば、その回路部品は装着されないようにされていたが、吸着エラーの判定範囲を更に広くし、例えば±４０度とすれば、回路部品に前記実施形態より広い範囲、例えば±１５度の範囲で保持方位誤差が生ずることがあっても（保持方位誤差は殆どの場合、±１０度の範囲内に収まり、何らかの異常が発生した場合でなければ±１５度を超えることはない場合）、吸着エラーが生じているとされることなく、装着と撮像とを並行して行うことができる。さらに、回路部品の装着と撮像とを並行して行う際の方位変更角度は±１５度の範囲内に限らず、他の角度範囲に設定することができる。例えば、回路部品に生ずる保持方位誤差が殆どの場合、±５度の範囲内に収まるとき、吸着エラーの判定範囲を±４０度にすれば、回路部品の方位変更角度が±３０度の範囲内であっても、装着と撮像とを並行して行うことができる。

【０２２８】さらに、前記実施形態において複数の部品保持具の保持方位誤差の補正および方位変更は、共通の駆動歯車および駆動源を用いて行われるようになっていたが、部品保持具の停止位置の１つ、あるいは移動軌跡中に保持具回転装置を設けて部品保持具を回転させるようにしてもよい。部品保持具に、保持具回転装置に設けられた係合部材と係合する係合部を設け、係合部材と係合可能な位置に至った部品保持具の係合部に係合部材を係合させ、軸線まわりに回転させて保持方位誤差の補正および方位の変更を行うのである。

【０２２９】また、部品保持具の保持方位誤差の補正および方位の変更は、部品保持具の旋回中に限らず、停止した状態で行ってもよい。

【０２３０】さらに、先の説明において部品保持具は、停止位置の前後において移動（旋回）させられるとともに下降，上昇させられるようになっていたが、停止位置の前と後とのいずれか一方において移動（旋回）と下降，上昇とが並行して行われるようにしてもよい。

【０２３１】また、部品保持具が部品受取装着位置に停止させられる場合であっても、何らかの事情で部品保持具に設けられたカムフォロワが切欠に嵌入したままの状態で部品保持具の移動が開始されることがあっても、カムフォロワが切欠を通過することにより損傷が回避される。

【０２３２】さらに、前記実施形態において昇降駆動部材は、部品吸着軸の回路部品を吸着し、装着する際の旋回時に、リニアモータ等の誤作動等によって下降位置にあるときに退避位置へ回動させられるようになっていたが、部品吸着軸が逆方向に旋回させられる場合にも、昇降駆動部材が誤作動等により下降位置にあるとき、部品吸着軸により退避位置へ回動させられるようにしてもよい。

【０２３３】また、先の説明において、回路部品の装着

時にリニアモータにより下降させられる移動部材の下降速度は、加速後、減速させられて、回路部品がプリント基板に接触させられるときに衝撃少なく接触させられ、減速を続けて下降端位置まで下降させられるようになっていたが、回路部品がプリント基板に接触した後は、加速して移動部材が迅速に下降端位置へ到達するようにしてもよい。

【０２３４】さらに、図１ないし図３２に示す実施形態において、駆動歯車の幅が被駆動歯車の幅より広くされていたが、逆でもよい。

【０２３５】また、部品保持具に保持された回路部品を撮像する撮像装置は、回路部品の正面像を取得するものとしてもよい。

【０２３６】さらに、先の説明においては部品保持具が自身の軸線のまわりに回転させられることにより、回路部品の保持方位誤差が補正されるとともに、回路部品の方位が受取り時とは異なる方位に変更されるようになっていたが、回路部品を方位を変更しないで回路基材に装着し、保持方位誤差の補正のみが行われることもある。

【０２３７】請求項３に記載の特徴は、第１発明または第２発明とは別に実施することも可能である。すなわち、回路部品装着システムを、回路部品を供給する部品供給装置を、回路部品を装着すべき回路基材を保持する回路基材保持装置の両側に１つずつ２つ有するとともに、①それぞれ回路部品を保持する複数の部品保持具、②それら複数の部品保持具を保持して共通の旋回軸線のまわりに旋回させるとともに所定の位置に停止させる保持具旋回装置、③その保持具旋回装置を保持する搬送用移動部材を備え、その搬送用移動部材を移動させることによって保持具旋回装置を部品供給装置と回路基材保持装置とに跨がる搬送平面内の任意の位置へ移動させる搬送用移動装置、④搬送用移動部材に保持されて部品保持具を昇降させる昇降装置および⑤部品保持具に部品供給装置から供給される回路部品を受け取らせ、回路基材保持装置に保持された回路基材に回路部品を装着させる受取装着制御装置を含む装着ユニットを２セット有し、２つの部品供給装置および回路基材保持装置が少なくとも装着作業中は静止させられるとともに、保持具旋回装置，搬送用移動装置，昇降装置および受取装着制御装置を制御する制御装置が、２セットの装着ユニットの一方に、２つの部品供給装置の一方から回路部品を受け取らせて前記回路基材に装着させ、装着ユニットの他方に、部品供給装置の他方から回路部品を受け取らせて回路基材に装着させ、かつ、それら２セットの装着ユニットに回路部品の受取りおよび装着を交互に行わせる交互装着制御手段を含むものとするのである。この回路部品装着システムにおいて保持具旋回装置および昇降装置は、例えば、前記特開平６－１９６５４６号公報に記載の保持具旋回装置および昇降装置のように、複数の部品保持具の各々を任意の位置に停止させるとともに、部品保持具を昇降させて回路部品の受取りおよび装着を行わせる装置とされるなど、種々の態様の保持具旋回装置および昇降装置の採用が可能である。

【０２３８】さらに、本発明は、前記各実施形態の構成要素の組合わせを変えた態様で実施することができる。その他、特許請求の範囲を逸脱することなく、当業者の知識に基づいて種々の変形，改良を施した態様で本発明を実施することができる。

【図面の簡単な説明】

【図１】第１ないし第９発明に共通の一実施形態である回路部品装着システムを示す平面図である。

【図２】上記回路部品装着システムを構成する基板コンベヤを示す正面図である。

【図３】上記回路部品装着システムを構成する基板コンベヤおよび回路部品装着装置を示す側面図である。

【図４】上記基板コンベヤを取り出して示す平面図である。

【図５】上記基板コンベヤを構成するメインコンベヤを示す側面図である。

【図６】上記基板コンベヤの搬入コンベヤ，メインコンベヤおよび搬出コンベヤの各搬送幅を調節するためのチェーンおよびスプロケットの配置を示す図である。

【図７】上記回路部品装着システムを構成する回路部品供給装置を示す側面図である。

【図８】上記回路部品供給装置と回路部品装着システムの基台との接続部分を示す側面図（一部断面）である。

【図９】上記回路部品供給装置を構成するフィーダを示す側面図である。

【図１０】上記フィーダの部品保持テープの送りの部分を拡大して示す側面図である。

【図１１】上記回路部品装着システムを構成する回路部品装着装置の装着ヘッドをＸ軸スライドと共に示す正面図（一部断面）である。

【図１２】上記装着ヘッドに設けられた部品吸着軸を示す正面断面図である。

【図１３】上記装着ヘッドの回路部品撮像装置が設けられた部分を示す平面図である。

【図１４】上記装着ヘッドを示す平面図である。

【図１５】上記装着ヘッドをＸ軸スライドと共に示す正面図である。

【図１６】上記装着ヘッドに設けられた部品吸着軸の配置を概略的に示す図である。

【図１７】上記装着ヘッドに設けられた切換弁制御装置の機構部を示す平面図である。

【図１８】上記切換弁制御装置の機構部を示す正面図である。

【図１９】上記切換弁制御装置の機構部を示す側面図である。

【図２０】上記切換弁制御装置の圧力切換弁を負圧供給状態に切り換える側の部分および個別昇降装置を示す正

面図である。

【図２１】上記切換弁制御装置の圧力切換弁を負圧供給状態に切り換える側の部分および個別昇降装置を示す側面図である。

【図２２】図２０におけるXXII-XXII 断面図である。

【図２３】上記切換弁制御装置の圧力切換弁を負圧供給状態に切り換える側の作用部材を主エアシリンダと共に示す正面断面図である。

【図２４】本回路部品装着システムを制御する制御装置のうち、本発明に関連の深い部分を概略的に示すブロック図である。

【図２５】上記回路部品装着システムの回路部品の吸着，撮像，搬送および装着の１態様におけるＸＹロボットの移動，間欠回転体の回転，部品吸着軸の回転および昇降，フィーダにおける部品保持テープの送りおよび回路部品撮像装置の作動タイミングを示すタイムチャートである。

【図２６】回路部品の吸着，装着時における切換弁制御装置の主エアシリンダおよび補助エアシリンダの駆動指令および作動状態を示す図表である。

【図２７】回路部品吸着時における切換弁制御装置の作動状態を示す側面図である。

【図２８】小さい回路部品の装着時における切換弁制御装置の作動状態を示す側面図である。

【図２９】大きい回路部品の装着時における切換弁制御装置の作動状態を示す側面図である。

【図３０】回路部品の吸着数が２０個であって、回路部品の撮像と装着とが並行して行われる態様での方位誤差角度，画像認識角度，方位誤差補正角度，方位変更角度および装着時吸着軸トータル回転角度を示す図表である。

【図３１】回路部品の吸着数が２０個であって、回路部品の撮像が装着とは別に行われる態様での方位誤差角度，画像認識角度，方位誤差補正角度，方位変更角度および装着時吸着軸トータル回転角度を示す図表である。

【図３２】回路部品の吸着数が１７個の場合における方位誤差角度，画像認識角度，方位誤差補正角度，方位変更角度および装着時吸着軸トータル回転角度を示す図表である。

【図３３】第１ないし第５，第８，第９発明に共通の実施形態である回路部品装着システムの装着ヘッドをＸ軸スライドと共に示す正面図（一部断面）である。

【図３４】図３３に示す装着ヘッドをＸ軸スライドと共に示す左側面図である。

【図３５】図３３に示す装着ヘッドの間欠回転体の上部を示す平面図である。

【図３６】図３３に示す装着ヘッドの間欠回転体の下部を示す平面図である。

【図３７】図３３に示す装着ヘッドの部品吸着軸が吸着軸保持部材により保持された状態を示す正面断面図である。

【図３８】装着ヘッドに２種類の部品吸着ノズルが搭載される場合の部品吸着ノズルの配置の一例を概略的に示す図である。

【図３９】装着ヘッドに２種類の部品吸着ノズルが搭載される場合の部品吸着ノズルの配置の別の態様を概略的に示す図である。

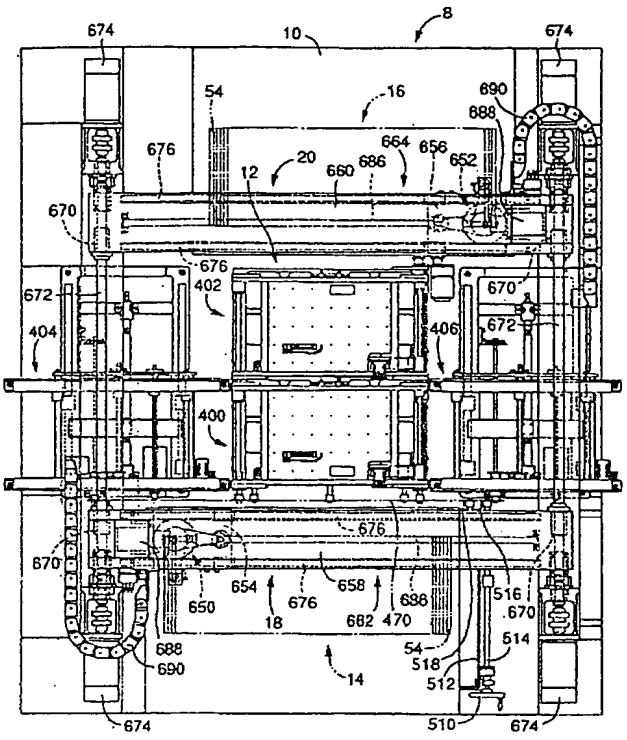
【図４０】装着ヘッドに３種類の部品吸着ノズルが搭載される場合の部品吸着ノズルの配置を概略的に示す図である。

【図４１】回路部品装着装置を構成する切換弁制御装置において部品吸着ノズルへのエアの供給を制御する部分の別の態様を示す回路図である。

【符号の説明】

８：回路部品装着システム　　１２：基板コンベヤ　　１４，１６：回路部品供給装置　　１８，２０：回路部品装着装置　　４００，４０２：メインコンベヤ　　４０４：搬入コンベヤ　　４０６：搬出コンベヤ　　４０８：プリント基板　　４３８：搬入コンベヤシフト装置　　５０８：搬出コンベヤシフト装置　　６５０，６５２：装着ヘッド　　６６２，６６４：ＸＹロボット　　７１２：固定カム　　７１６：駆動歯車　　７２４：方位変更用サーボモータ　　７４２：旋回用サーボモータ　　７６２：間欠回転体　　７７６：部品吸着軸　　７８４：部品吸着ノズル　　８００：被駆動歯車　　８０４：カムフォロワ　　８０８：カム面　　８２０：回路部品撮像装置　　８４２：回路部品　　８６０：圧力切換弁　　８８０：個別昇降装置　　８８２：切換弁制御装置　　８９０：移動部材　　８９２：昇降駆動部材　　９３０：主エアシリンダ　　９５２：作用部材　　９７４：主エアシリンダ　　９８４：補助エアシリンダ　　１００２：作用部材　　１０３０：リンク　　１０５０：制御装置　　１１００：装着ヘッド　　１１０２：ＸＹロボット　　１１３８：旋回用サーボモータ　　１１５０：駆動かさ歯車　　１１５４：方位補正変更用サーボモータ　　１１６４：間欠回転体　　１１８２：被駆動かさ歯車　　１１９４：部品吸着ノズル　　１２６０：圧力切換弁　　１２９０：回路部品撮像装置　　１３０２：個別昇降装置　　１３０４：切換弁制御装置　　１３１４：移動部材　　１３２０：主エアシリンダ　　１３２２：作用部材　　１３３０，１３３２，１３４０，１３４２，１３４４：部品吸着ノズル　　１４００：圧力切換弁

【図１】



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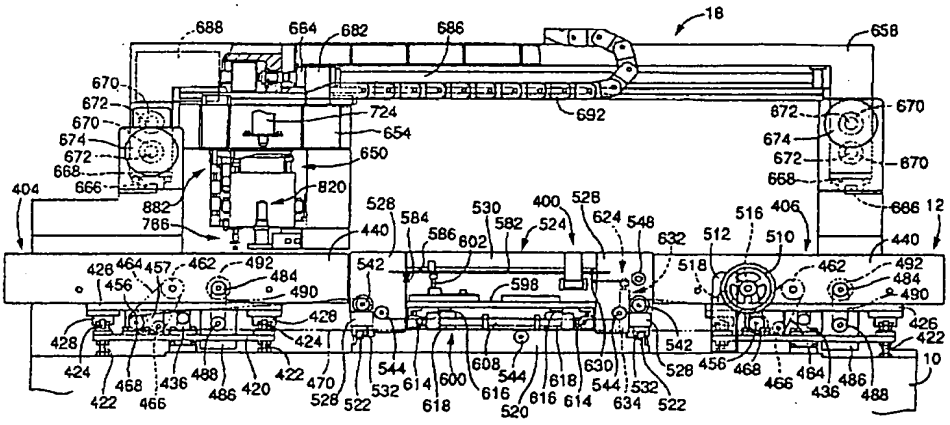

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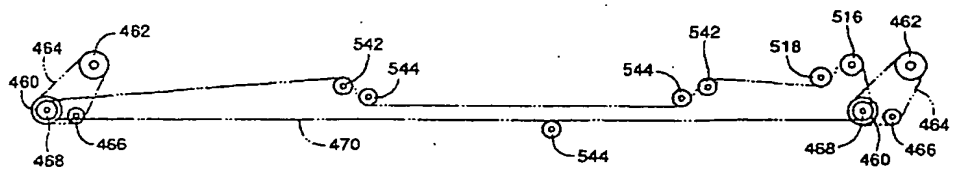

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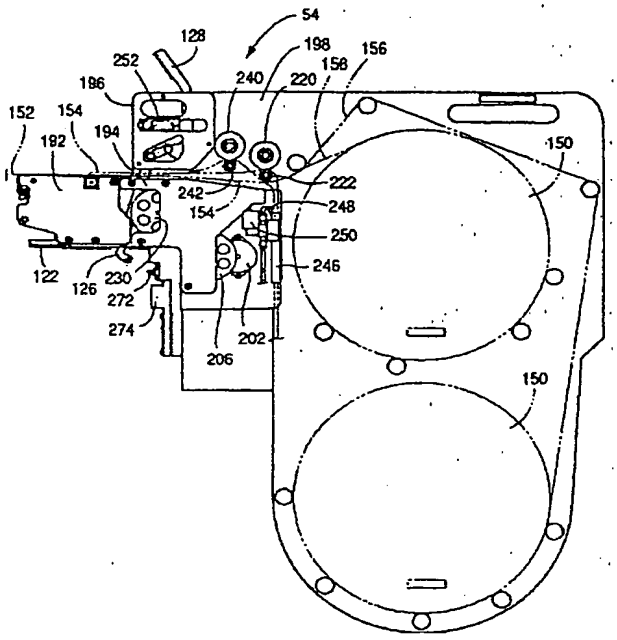
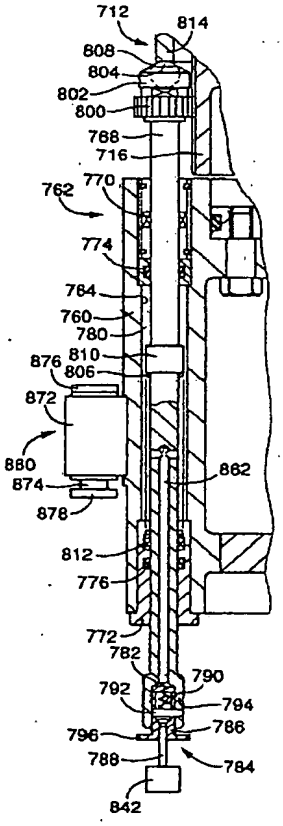


【図１２】



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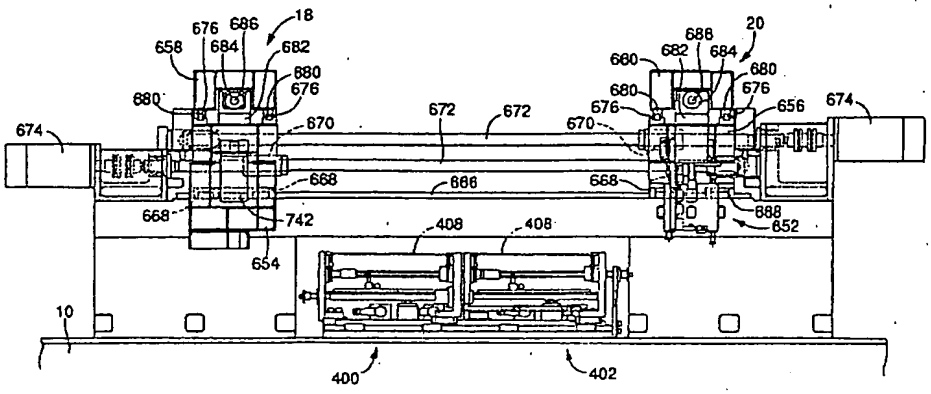

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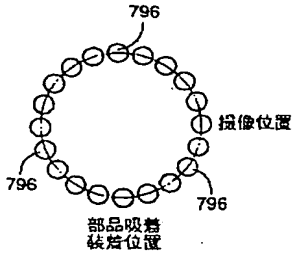
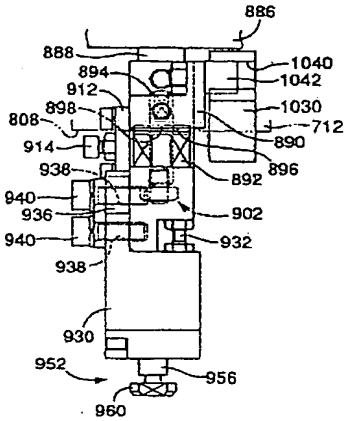


【図２１】



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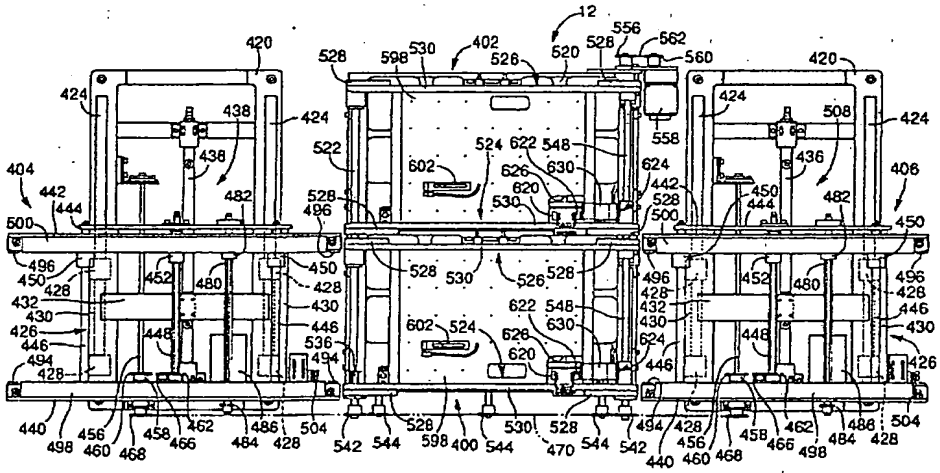

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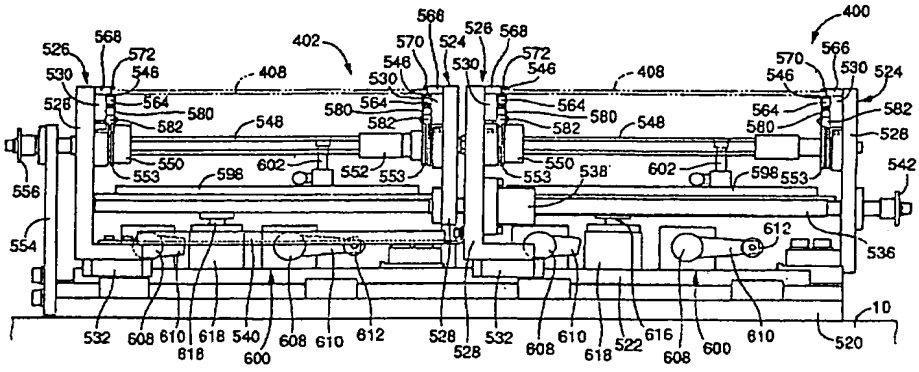

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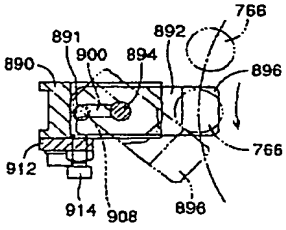

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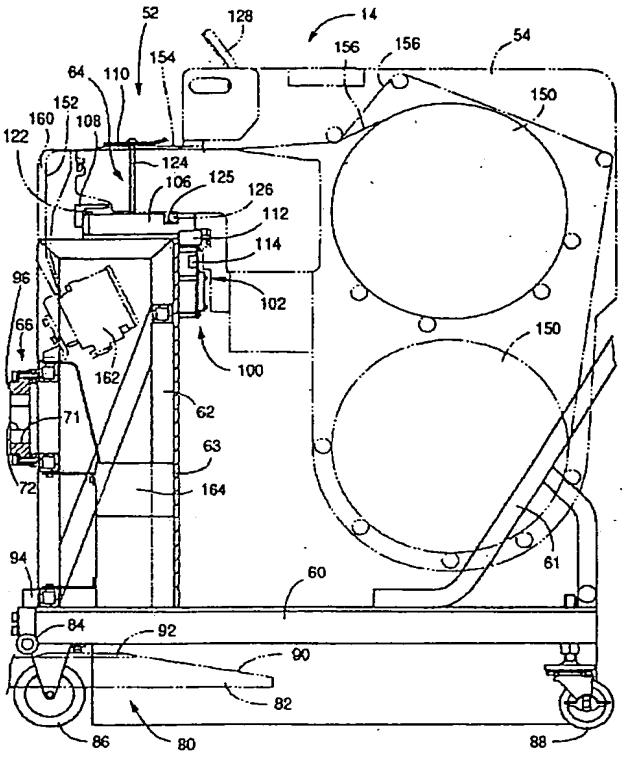
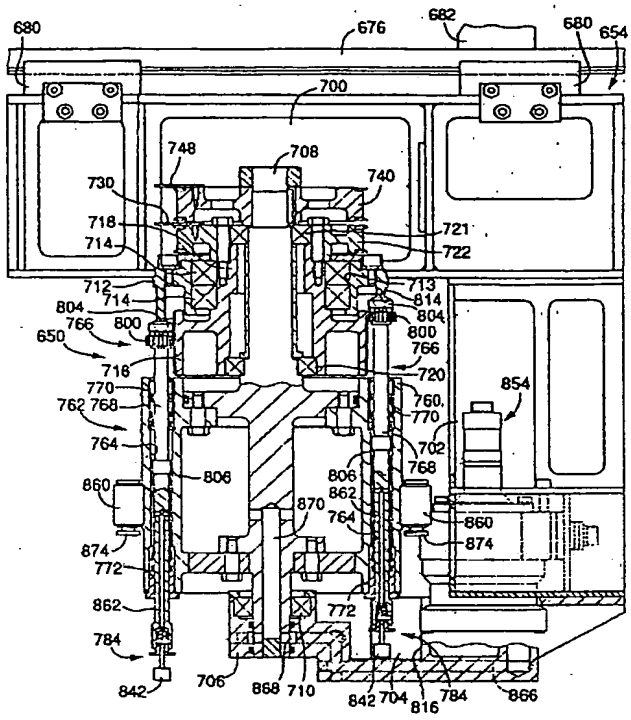


【図１１】



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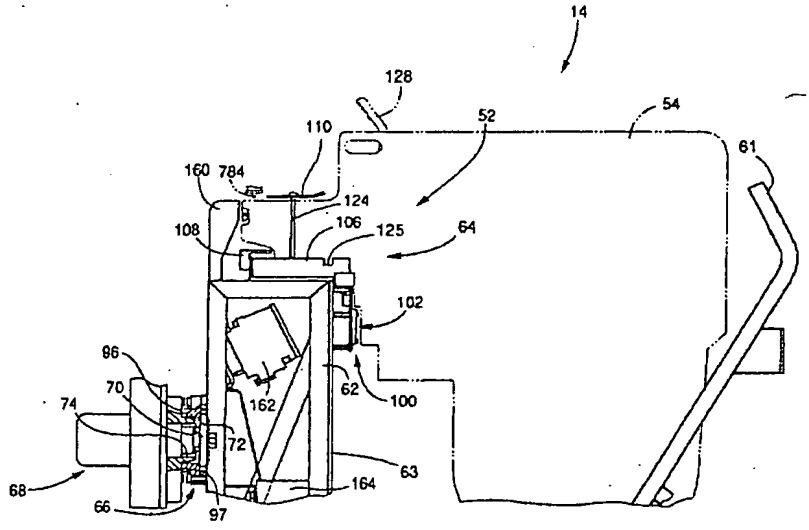

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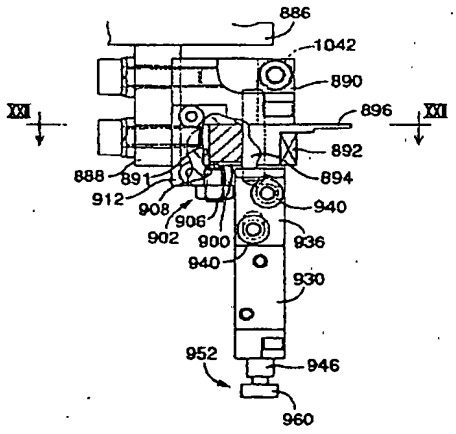

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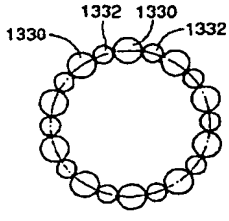

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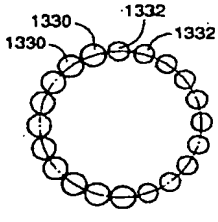
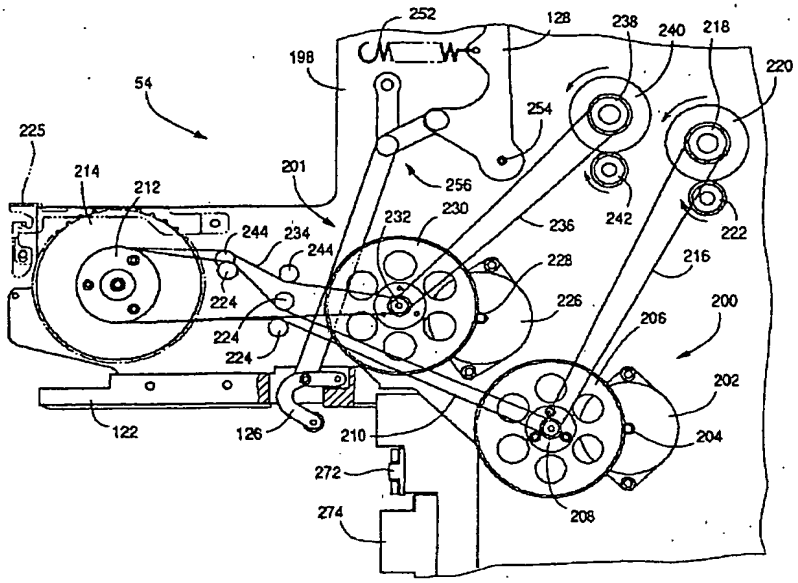


【図１０】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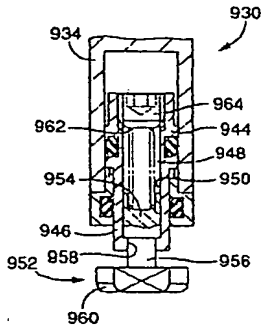
【図２３】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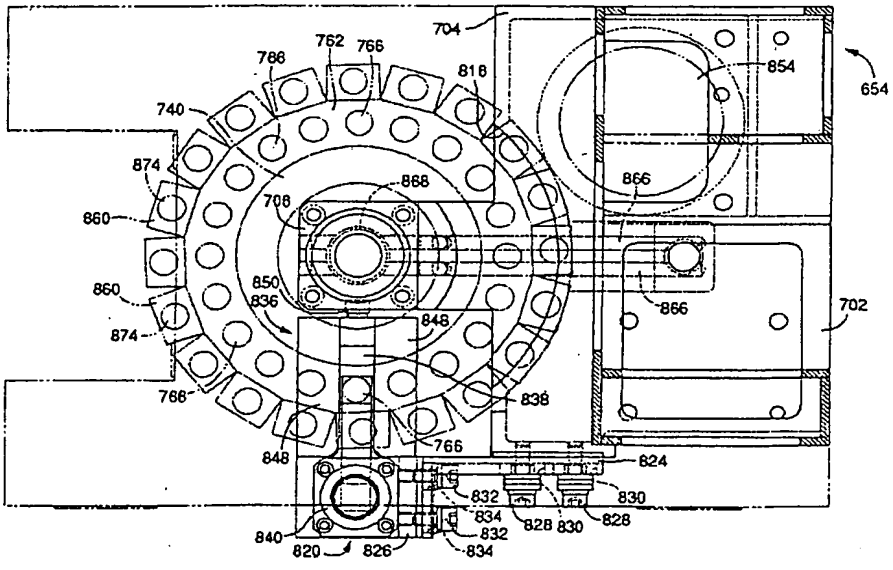
【図１３】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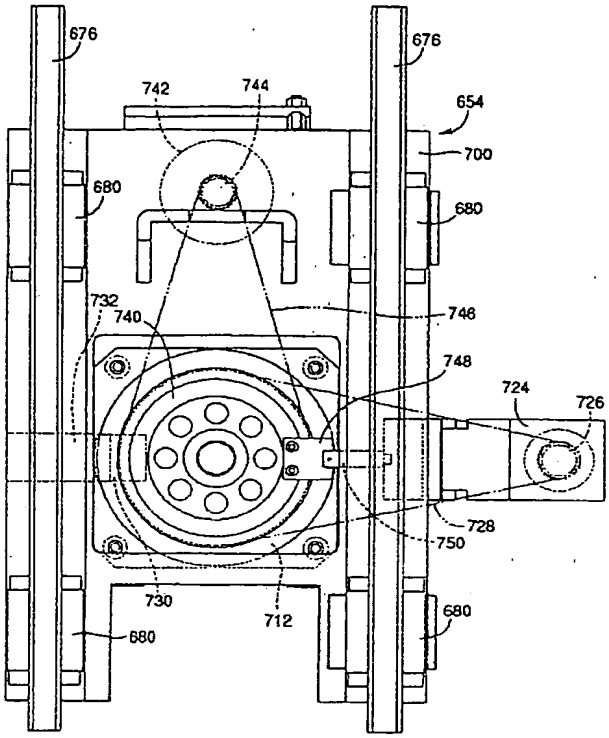
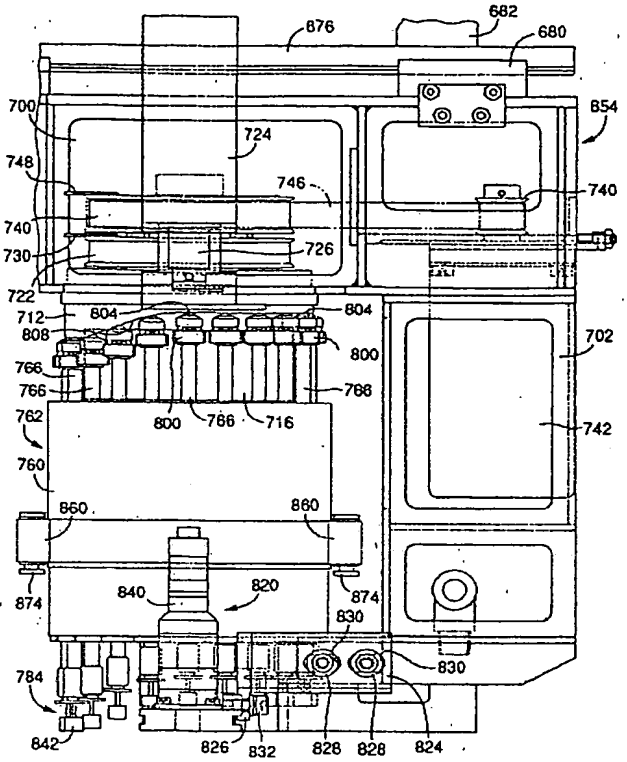
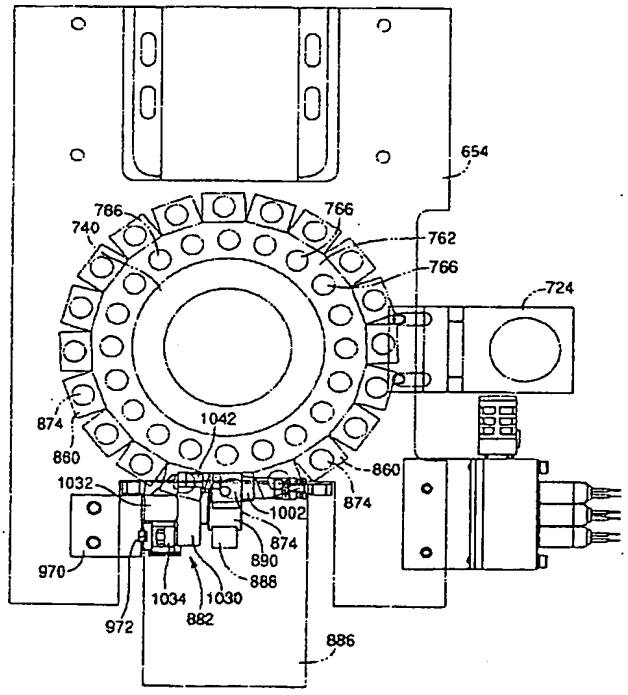
【図１４】



【図１５】



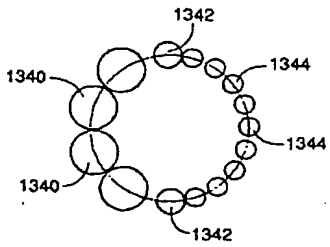
【図１７】



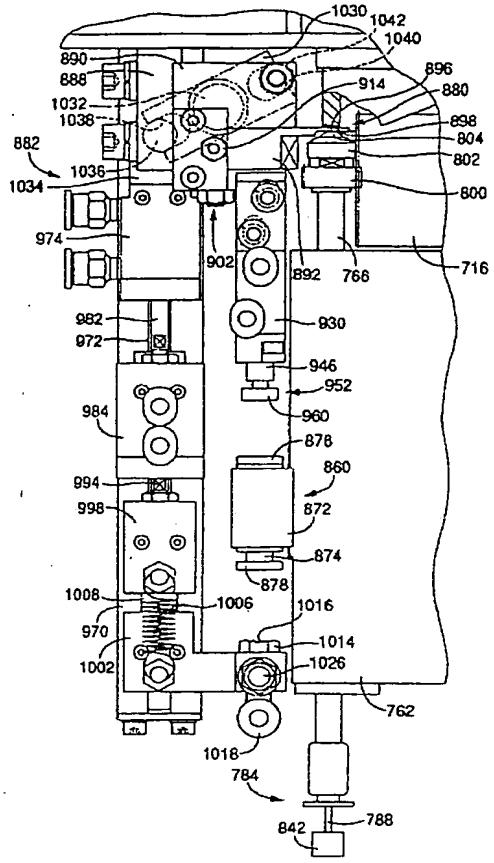
【図２６】

シリンダ		目的動作		
		吸着	装着 部品高さ 0～3mm	装着 部品高さ 3～6mm
主エアシリンダ 930	シリンダ作動状態	突出状態	引込状態	引込状態
	シリンダ駆動指令	ON	OFF	OFF
主エアシリンダ 974	シリンダ作動状態	突出状態	引込状態	引込状態
	シリンダ駆動指令	OFF	ON	ON
補助エアシリンダ 984	シリンダ作動状態	引込状態	突出状態	引込状態
	シリンダ駆動指令	ON	OFF	ON

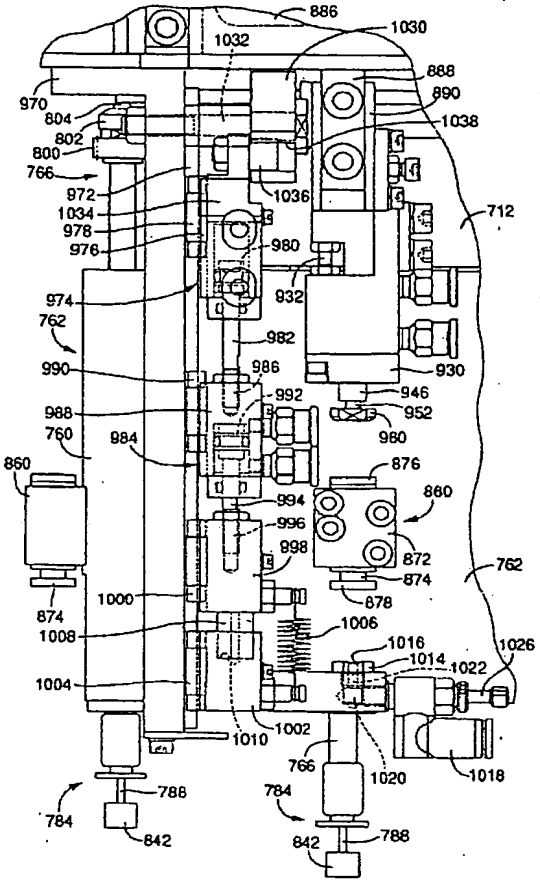
【図４０】



【図１８】



【図１９】



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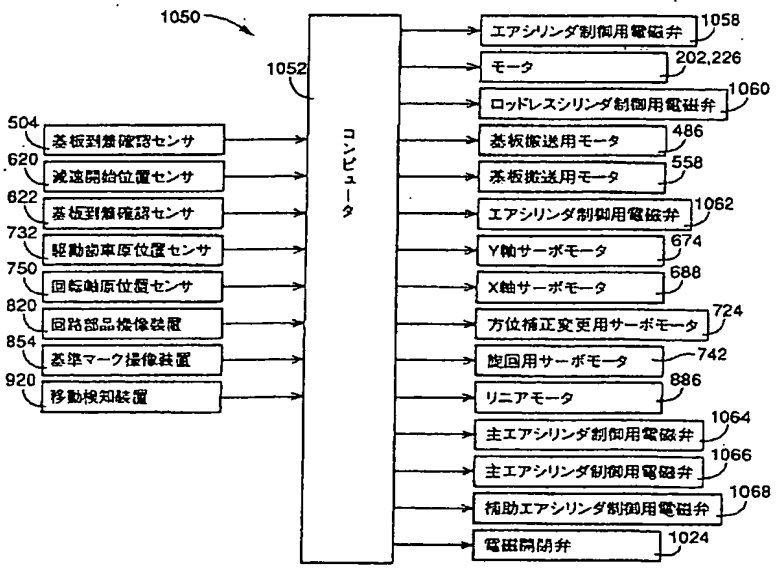
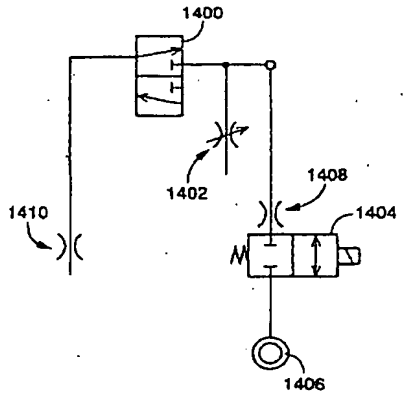
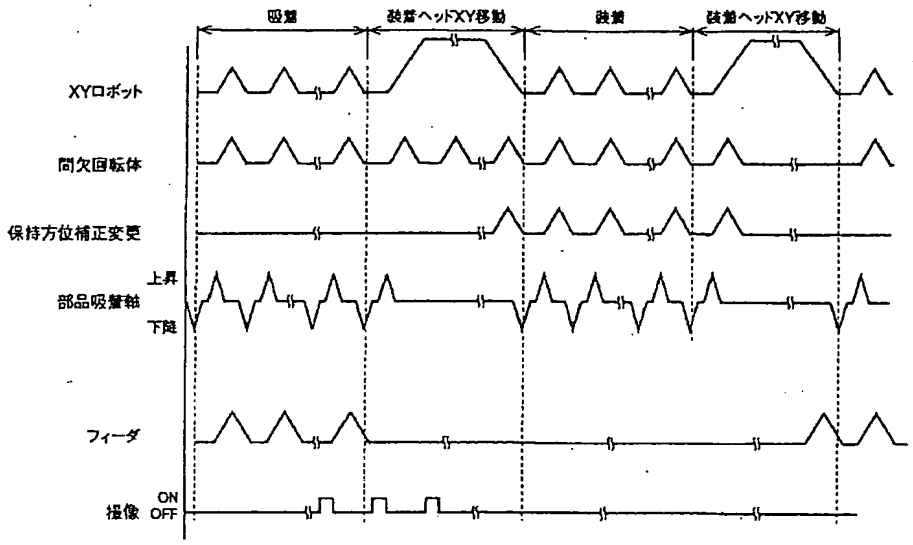


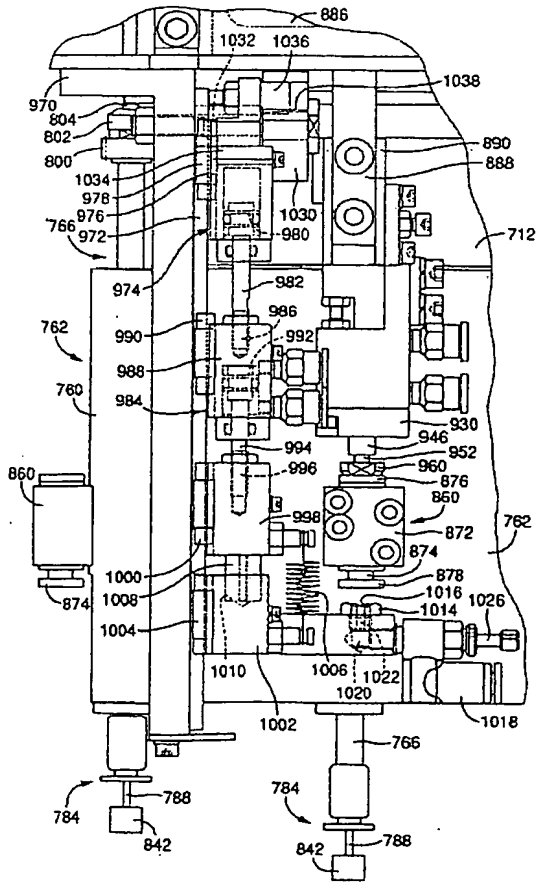
【図４１】



【図２５】


吸着
装着ヘッドXY移動
装着
装着ヘッドXY移動
XYロボット
間欠回転体
保持方位補正変更
部品吸着軸
上昇
下降
フィーダ
撮像
ON
OFF

【図２７】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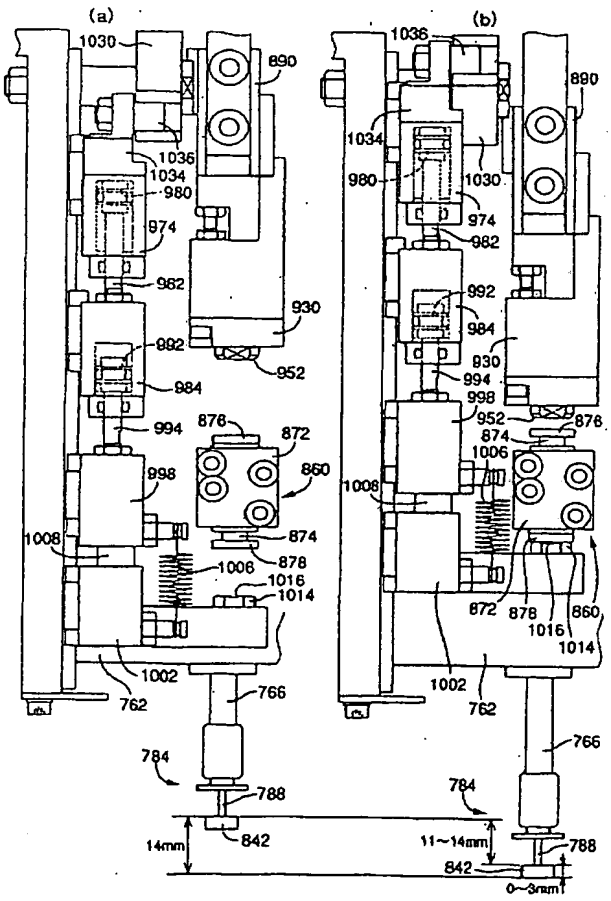
【図２８】


(a)
(b)
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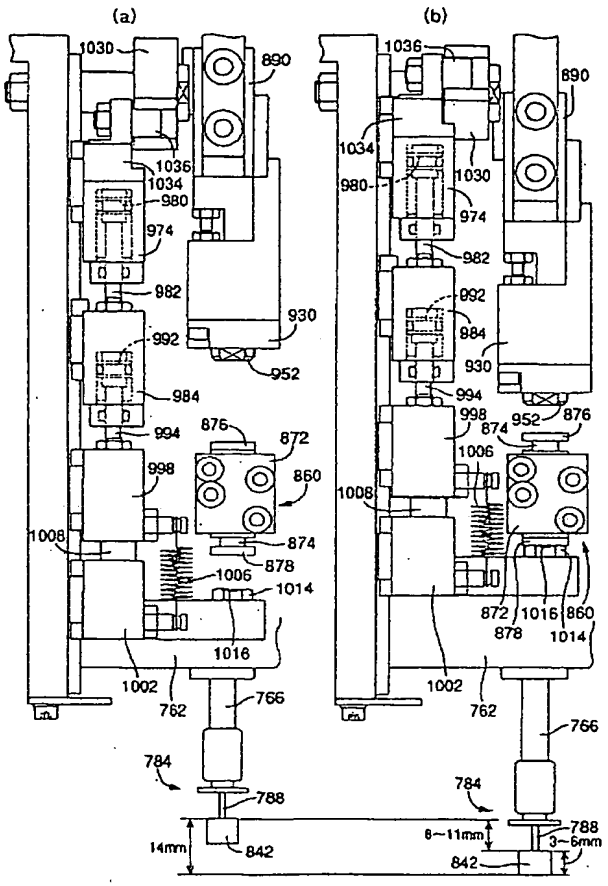
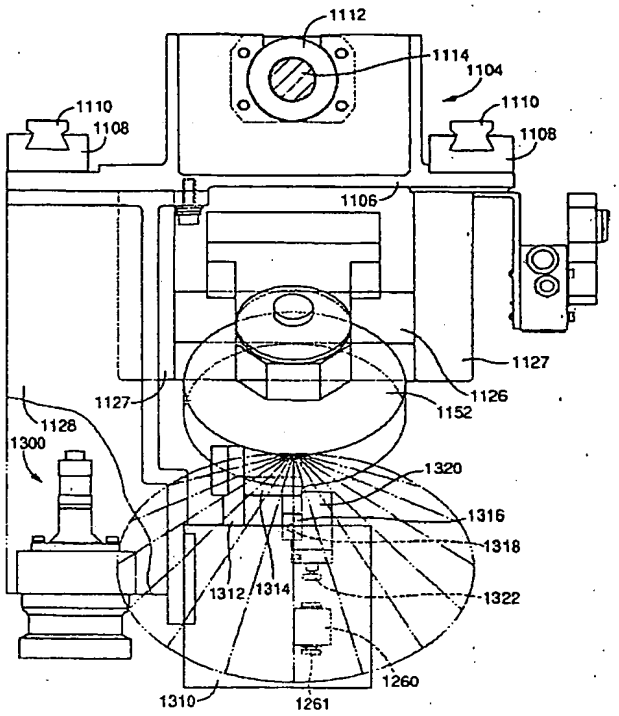
994
876
872
860
998
1008
874
1006
878
1016
1014
1002
762
766
784
788
842
14mm
11~14mm
0~3mm

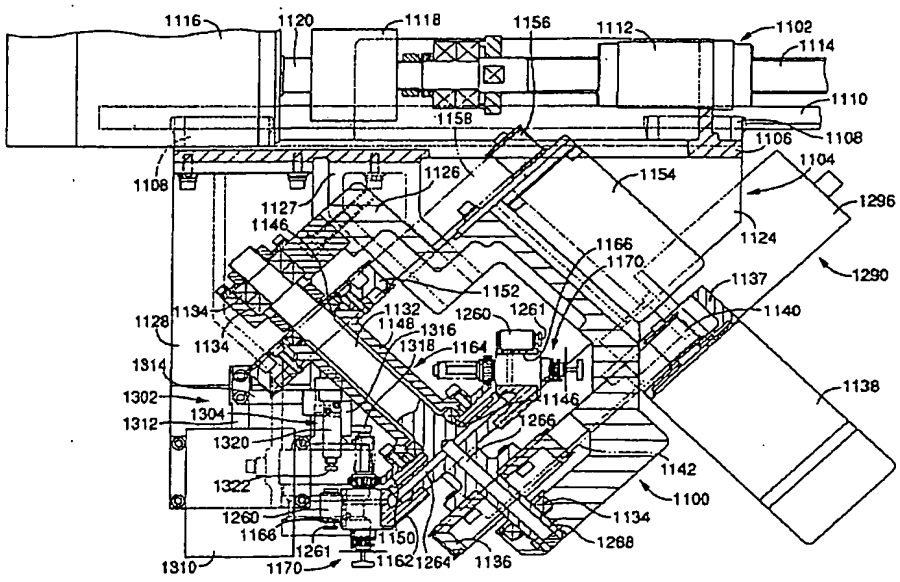
【図２９】


(a)
(b)
1030
890
1036
1034
980
974
982
930
992
952
984
994
876
872
998
860
1008
874
878
1006
1014
1016
1002
762
766
784
788
842
14mm
8~11mm
3~6mm

【図３４】


1112
1114
1104
1110
1108
1106
1127
1126
1152
1128
1300
1320
1316
1318
1322
1312
1314
1260
1310
1261

【図３３】


1116
1120
1118
1156
1112
1102
1114
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1158
1106
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1104
1126
1154
1127
1146
1296
1124
1166
1170
1290
1137
1152
1140
1132
1260
1261
1148
1316
1318
1164
1128
1134
1314
1302
1304
1312
1320
1322
1260
1166
1261
1310
1170
1150
1162
1264
1136
1146
1266
1142
1100
1134
1268
1138

【図３０】

NO.	方位誤差角度	画像認識角度	方位誤差補正角度	方位変更角度	装着時吸着軸トータル回転角度
1	θ1a				
2	θ2a				
3	θ3a				
4	θ4a				
5	θ5a				
6	θ6a	θ1a			
7	θ7a	θ2a			
8	θ8a	θ3a			
9	θ9a	θ4a			
10	θ10a	θ5a			
11	θ11a	θ6a			
12	θ12a	θ7a			
13	θ13a	θ8a			
14	θ14a	θ9a			
15	θ15a	θ10a			
16	θ16a	θ11a			
17	θ17a	θ12a			
18	θ18a	θ13a			
19	θ19a	θ14a			
20	θ20a	θ15a			
21		θ16a-θ1a+θ1b	-θ1a	θ1b	-θ1a+θ1b
22		θ17a-θ2a+θ2b	-θ2a	θ2b	-θ2a+θ2b
23		θ18a-θ3a+θ3b	-θ3a	θ3b	-θ3a+θ3b
24		θ19a-θ4a+θ4b	-θ4a	θ4b	-θ4a+θ4b
25		θ20a-θ5a+θ5b	-θ5a	θ5b	-θ5a+θ5b
26			-θ6a	θ6b	-θ6a+θ6b
27			-θ7a	θ7b	-θ7a+θ7b
28			-θ8a	θ8b	-θ8a+θ8b
29			-θ9a	θ9b	-θ9a+θ9b
30			-θ10a	θ10b	-θ10a+θ10b
31			-θ11a	θ11b	-θ11a+θ11b
32			-θ12a	θ12b	-θ12a+θ12b
33			-θ13a	θ13b	-θ13a+θ13b
34			-θ14a	θ14b	-θ14a+θ14b
35			-θ15a	θ15b	-θ15a+θ15b
36			-θ16a+θ1a-θ1b	θ16b	(-θ16a+θ1a-θ1b)+θ16b
37			-θ17a+θ2a-θ2b	θ17b	(-θ17a+θ2a-θ2b)+θ17b
38			-θ18a+θ3a-θ3b	θ18b	(-θ18a+θ3a-θ3b)+θ18b
39			-θ19a+θ4a-θ4b	θ19b	(-θ19a+θ4a-θ4b)+θ19b
40			-θ20a+θ5a-θ5b	θ20b	(-θ20a+θ5a-θ5b)+θ20b

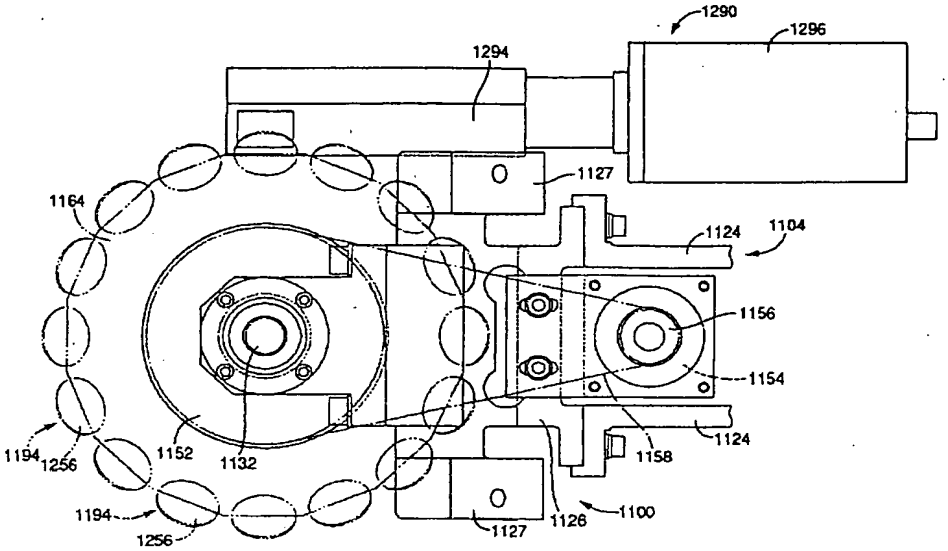
【図３１】

NO.	方位誤差角度	画像認識角度	方位誤差補正角度	方位変更角度	装着時吸着軸トータル回転角度
1	θ1a				
2	θ2a				
3	θ3a				
4	θ4a				
5	θ5a				
6	θ6a	θ1a			
7	θ7a	θ2a			
8	θ8a	θ3a			
9	θ9a	θ4a			
10	θ10a	θ5a			
11	θ11a	θ6a			
12	θ12a	θ7a			
13	θ13a	θ8a			
14	θ14a	θ9a			
15	θ15a	θ10a			
16	θ16a	θ11a			
17	θ17a	θ12a			
18	θ18a	θ13a			
19	θ19a	θ14a			
20	θ20a	θ15a			
21		θ16a			
22		θ17a			
23		θ18a			
24		θ19a			
25		θ20a			
26			-θ1a	θ1b	-θ1a+θ1b
27			-θ2a	θ2b	-θ2a+θ2b
28			-θ3a	θ3b	-θ3a+θ3b
29			-θ4a	θ4b	-θ4a+θ4b
30			-θ5a	θ5b	-θ5a+θ5b
31			-θ6a	θ6b	-θ6a+θ6b
32			-θ7a	θ7b	-θ7a+θ7b
33			-θ8a	θ8b	-θ8a+θ8b
34			-θ9a	θ9b	-θ9a+θ9b
35			-θ10a	θ10b	-θ10a+θ10b
36			-θ11a	θ11b	-θ11a+θ11b
37			-θ12a	θ12b	-θ12a+θ12b
38			-θ13a	θ13b	-θ13a+θ13b
39			-θ14a	θ14b	-θ14a+θ14b
40			-θ15a	θ15b	-θ15a+θ15b
41			-θ16a	θ16b	-θ16a+θ16b
42			-θ17a	θ17b	-θ17a+θ17b
43			-θ18a	θ18b	-θ18a+θ18b
44			-θ19a	θ19b	-θ19a+θ19b
45			-θ20a	θ20b	-θ20a+θ20b

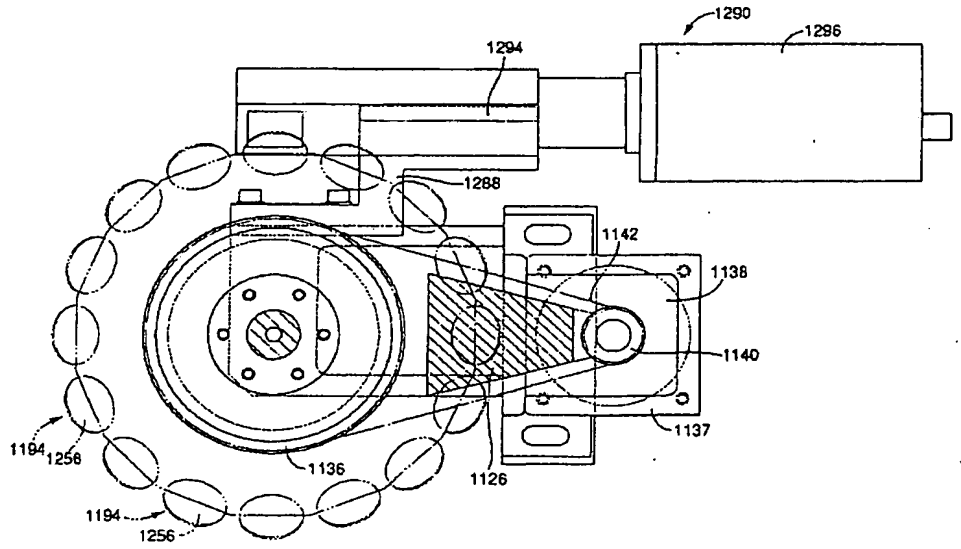
【図３２】

NO.	方位誤差角度	画像認識角度	方位誤差補正角度	方位変更角度	装着時吸着軸トータル回転角度
1	θ1a				
2	θ2a				
3	θ3a				
4	θ4a				
5	θ5a				
6	θ6a	θ1a			
7	θ7a	θ2a			
8	θ8a	θ3a			
9	θ9a	θ4a			
10	θ10a	θ5a			
11	θ11a	θ6a			
12	θ12a	θ7a			
13	θ13a	θ8a			
14	θ14a	θ9a			
15	θ15a	θ10a			
16	θ16a	θ11a			
17	θ17a	θ12a			
18		θ13a			
19		θ14a			
20		θ15a			
21		θ16a-θ1a+θ1b	-θ1a	θ1b	-θ1a+θ1b
22		θ17a-θ2a+θ2b	-θ2a	θ2b	-θ2a+θ2b
23			-θ3a	θ3b	-θ3a+θ3b
24			-θ4a	θ4b	-θ4a+θ4b
25			-θ5a	θ5b	-θ5a+θ5b
26			-θ6a	θ6b	-θ6a+θ6b
27			-θ7a	θ7b	-θ7a+θ7b
28			-θ8a	θ8b	-θ8a+θ8b
29			-θ9a	θ9b	-θ9a+θ9b
30			-θ10a	θ10b	-θ10a+θ10b
31			-θ11a	θ11b	-θ11a+θ11b
32			-θ12a	θ12b	-θ12a+θ12b
33			-θ13a	θ13b	-θ13a+θ13b
34			-θ14a	θ14b	-θ14a+θ14b
35			-θ15a	θ15b	-θ15a+θ15b
36			-θ16a+θ1a-θ1b	θ16b	(-θ16a+θ1a-θ1b) +θ16b
37			-θ17a+θ2a-θ2b	θ17b	(-θ17a+θ2a-θ2b) +θ17b
38					
39					
40					

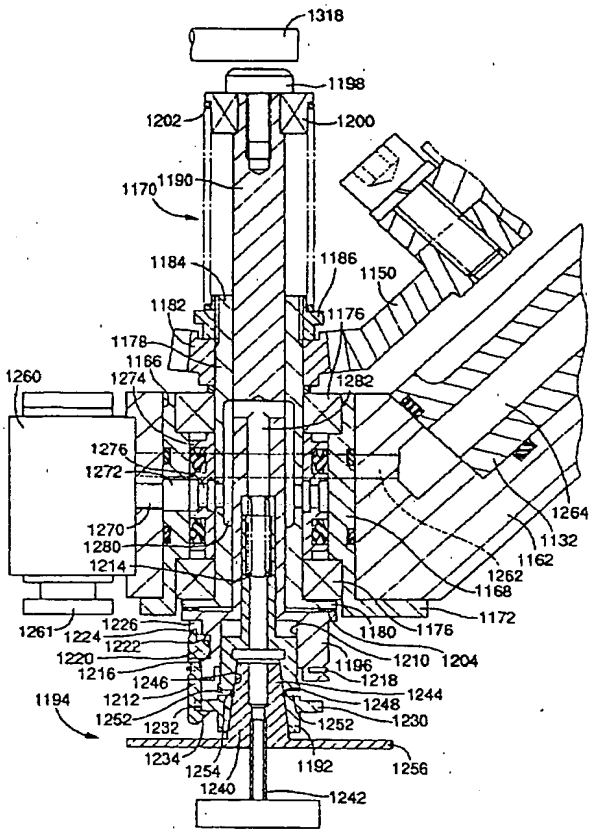
【図３５】


1290
1296
1294
1127
1164
1124
1104
1156
1154
1194
1256
1152
1132
1158
1124
1194
1256
1126
1100
1127

【図３６】


1290
1296
1294
1288
1142
1138
1140
1137
1194
1256
1136
1126
1194
1256

【図３７】


1318
1198
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1200
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1150
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1178
1166
1260
1274
1282
1276
1272
1264
1270
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1214
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1180
1176
1222
1220
1196
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1204
1216
1218
1246
1244
1212
1248
1194
1252
1230
1232
1252
1234
1254
1192
1256
1240
1242